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POPULAR ELECTRONICS

JANUARY 1963

35 CENTS

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BC Flash Gun Goes A.C.

Rewire to Instant Sound

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PLUS:
Science Fair Project
(see page 51)

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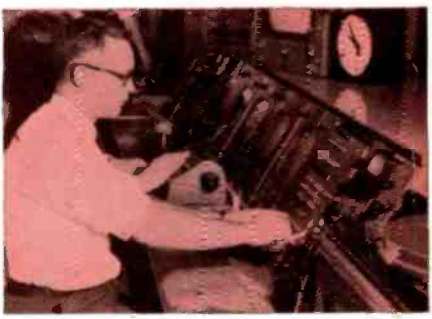

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POPULAR ELECTRONICS

ZIFF-DAVIS PUBLISHING COMPANY

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

This month's cover photo by Bruce Pendleton

VOLUME 18 JANUARY 1963 NUMBER 1

Special Construction Feature

Electronic Construction Projects

Audio and High Fidelity

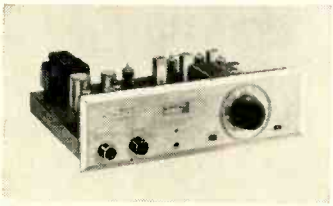
Amateur, CB, and SWL

Electronic Features and New Developments

Departments

Scott Stereo Tuner Kit Wins Rave Reviews from every Leading Hi-Fi Expert!

Just one year ago Scott introduced the LT-110 FM Stereo Tuner Kit. High Fidelity Dealers built this superb kit themselves, examined its many features, and recommended it without reservation. Enthusiastic kit builders deluged us with mail. Now the verdict is in from all the leading technical experts. Never before in the history of the industry has a single kit received such unanimous praise. We reprint a few excerpts below.



from Popular Electronics

A test model of the LT-110 was wired at POPULAR ELECTRONICS in just under five hours. Another 40 minutes was used for careful alignment and the tuner was "on the air." . . . The LT-110 met or exceeded all the manufacturer's detailed specifications on sensitivity, distortion, output level, a.c. hum, and capture ratio. . . . the audio response is excellent, being within ± 1 db, from approximately 20 to 16,000 cycles. . . . Channel-to-channel crosstalk is particularly excellent both in terms of uniformity and the fact that it holds up well above 10,000 cycles. . . . Frequency drift of the LT-110 from a cold start is extraordinarily low — less than 5 kc. The a.c. hum level (referred to 100% modulation) is low and exceeds the manufacturer's rating by 5 db. . . . It's difficult to imagine a kit much simpler to assemble than the LT-110. The full-color instruction book eliminates just about the last possible chance of wiring errors. . . . From a plain and simple operational standpoint, the LT-110 *works well and sounds good.*"

Popular Electronics, Oct. 1962

from ELECTRONICS WORLD

"Construction time for the unit we tested was 6½ hours, without alignment. . . . in listening tests, the tuner showed its high useable sensitivity to good advantage. Using an indoor antenna which produced marginal signal to noise ratios on most other tuners we were able to get noise-free, undistorted stereo reception."

Electronics World, Nov. 1962

from AUDIO

"The LT-110 (is) so simple to build that we unhesitatingly recommend it for even the novice. . . . We found that the useable sensitivity (IHFM) was 2.1 uv. . . . a fine stereo tuner and an unusually easy kit to build." Audio, April 1962

from RECORD GUIDE

"It seems to me that every time I turn around I am building another of H. H. Scott's kits. And each time I end up praising the unit to the skies.

The Scott instruction books should be a model for the industry. They feature full-color, step-by-step, illustrated directions. Each resistor or other component is shown in the progressive phases in its color code and in its proper position. . . .

This tuner kit has to be ranked on the same plane as H. H. Scott's factory-wired units. It is an excellent product. . . . very likely to give long, trouble-free service."

American Record Guide, Sept. 1962

Now Sonic Monitor* Added . . .

Scott's unique Sonic Monitor has now been added to the LT-110. This foolproof stereo signaling device tells you audibly when you are tuned to a stereo station.

LT-110 FM Stereo Tuner Kit . . . $159.95

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*Patent Pending. (All prices slightly higher West of Rockies.)

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Editorial and Executive Offices (ORegan 9-7200)
One Park Avenue, New York 16, New York

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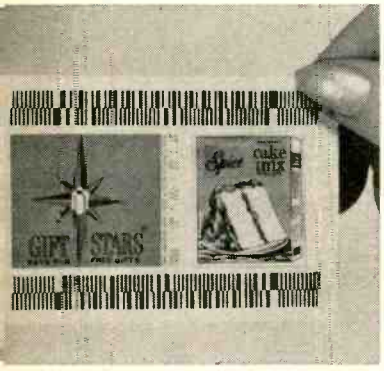
POP'tronics

NEWS SCOPE

PLASTIC RADAR EYE—Engineers are making final checks here on a new, almost transparent, shipboard radar antenna lens system that uses metalized plastic in place of heavier and less efficient aluminum. The manufacturer is the Sperry Gyroscope Company, Great Neck, N.Y. The lens system, which forms part of the radar setup used to help guide the U.S. Navy's "Talos" shipboard air defense missile, produces twice the signal gain of earlier metal versions. Molded of plastic-impregnated Fiberglas and coated with silver to make it electrically conductive, the lens is composed of 4100 separate cells which focus high-energy radar beams.



THE ELECTRIC EYES HAVE IT! A new nationwide gift coupon program to be launched by Gift Stars, Inc., of Minneapolis, Minn., has been made economically feasible by an optical scanning system capable of "reading" 1500 coupons per minute (11 billion coupons annually). The "Orthoscanner," developed by Honeywell Electronic Data Processing, Boston, Mass., scans the bar-coded data on the coupons and comes up with the following information: how much a coupon is worth, in whose product it was packed, and where it was distributed. All this and more, with an uncanny accuracy of 99.99%, even when handling soiled and partially torn coupons!

HIGHWAY CRANK—The development of an emergency signaling system, called "Turn Call," is undergoing field evaluation tests on a five-mile section of the Garden State Parkway in New Jersey. Developed by the ITT Kellogg Communications Systems Division of International Telephone and Telegraph Corporation, the system speeds rescue to the injured, or automobile service assistance to stranded drivers. "Turn Call" consists of a number of roadside transmitter units over which motorists can call police, ambulances, or service trucks, depending on their needs. Several turns of the call-box crank provide electrical power, and preset coded r.f. signals are picked up by receivers located at a service plaza, maintenance garage, or a toll booth where tie-in with the main toll road communication system is available.

GET LOST? Not with the new flight navigation device introduced by ACF Electronics, a division of ACF Industries, in Paramus, N.J. Installed in the cockpit of a small plane, the electronic navigator gives the pilot a continuous picture of his flight position by means of a small red dot that moves in synchronization with the plane across a course map. The moving dot acts in response to bearing and distance information transmitted by local Federal Aviation Agency ground radio stations and received by VOR (Very High Frequency Omni Range) and DME (Distance Measuring Equipment) in the aircraft. Tabbed the "Flitefix II," the device has a scale selector to coincide with the scale of any aeronautical map.

why settle for a routine job in electronics while others move ahead?

Read how CREI Grad Roy S. Reichert has advanced from maintenance work to the design of electronic equipment at one of the world's leading laboratories.

CREI GRAD ROY A. REICHERT makes an adjustment on the prototype of a programmable power supply which he designed and built in his capacity as Senior Tehnical Aide, Bell Telephone Labs, Murray Hill, N. J.

LET'S LOOK AT THE FACTS. Men with ordinary qualifications may always be accepted for routine, low-paying jobs. But for critical technical assignments in well-paying career positions with engineering status—where electronics is applied to the frontiers of the missile and space programs—only men with advanced technical knowledge will do.

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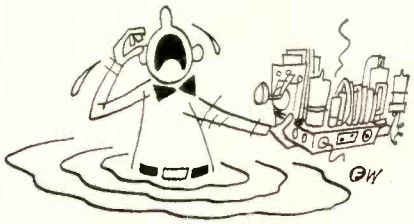
LETTER TRAY

Address correspondence for this department to: Letters Editor, POPULAR ELECTRONICS One Park Avenue, New York 16, N. Y.

Who Checks 'Em?

■ My results in building projects published in P.E. have been far from good. I never have complete success with these construction projects and



don't feel that it is my fault. Since I think many other P.E. readers feel as I do, can you tell me just what is done to insure that the claims made by an author are true?

PETER GALVIN
Nutley, N. J.

We're sorry, Peter, to hear that you have had some problems with construction projects published in P.E. As any author who has published an article in this magazine can tell you, our editors are pretty rough. Over 95% of the construction projects are tested in our offices and labs. Many of them are modified by the editors, and one out of every five is rebuilt to suit our specifications. Innumerable parts are changed each year in various projects to make items work better, or to be sure that comparable parts can be obtained throughout the United States.

In the past eight years we have found that three-fourths of the projects which readers claim don't work have been built from junk-box parts—laced with liberal substitutions. The rest of the "don't work" projects have been built by people who did not follow our detailed instructions.

"Drainpipe 8"

■ Having recently completed the remarkable speaker system in a sewer pipe ("Clean Sound from the Drainpipe 8," June, 1962), I would like to extend my congratulations to Mr. Weems on his excellent project. I am very happy with my version of it, which cost about $25.00—including the speaker. The reproduced sound compares favorably with many much more expensive systems.

CHARLES GEHRMAN
Baltimore, Md.

"Lodestar" Clarification

■ In the schematic and Parts List for "The Lodestar" (Sept., 1962), there is no mention of voltage

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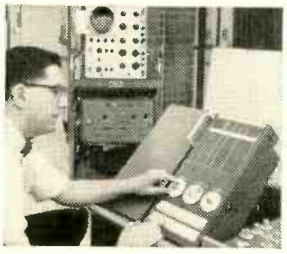

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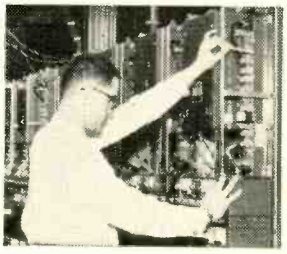

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PE-98

Letter Tray

(*Continued from page 8*)

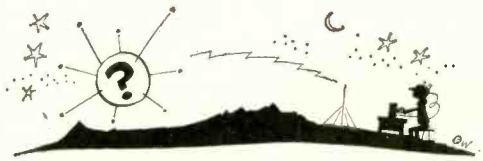
ratings for some of the capacitors. What should the ratings be?

ROBERT J. THORSTENSEN
Inglewood, Calif.

We didn't list voltages for the paper, mica, and ceramic capacitors because the voltages aren't critical. Just about any of these capacitor types will have a rating of at least 100 volts, which is well above the highest voltage you'll encounter in the "Lodestar."

Hear "Satellites on the Air"?

■ The monthly "Satellites on the Air" list seems like a very good idea, but it's hard to tell what



these satellites sound like and when you've zeroed in on one. How about providing some hints as to what to listen for?

FORBES ROCKWELL
North Andover, Mass.

We're sure that you, and many other P.E. readers, will be glad to know that just such an article is scheduled for next month. If you're just guessing about those "Satellites on the Air," our February issue will put you on the beacon.

In Defense of "A New Breed of Hams"

■ In the October, 1962, *Letter Tray*, you published a letter from hams John Maass and Peter Schumacher in which they called CB'ers "lids"—among other things. Granted, there are many CB licensees who are real jokers. They run wild on power, stick up 80' antennas solely for CB operation, "play" with their transmitters, and, in general, foul up the CB service for those who use it as it was intended to be used. With the aid of the FCC, we have tried to police our own ranks; but we still need help—constructive help—not just negative criticism. My message to the discontented "jugs" (which is what we CB'ers call hams) is that when one of them finds a CB'er violating the FCC regulations, he should notify the local CB club. And remember, there are some hams who need policing, too

ROBERT JONES, 12W1009
Sacramento, Calif.

■ Although I agree that many CB'ers have no respect for FCC regulations and should be removed from the air waves, there is much to be said against some hams, too. As an example, the other night I tuned in on 75 meters and came across what I believe to be one of the sorriest bunches of hams in the country. These operators—so wound up in high-power transmission—thought

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Cecil C. Hironimus, 113 Berwick Rd., Johnstown, Pa.	1st	12
Max D. Reece, 4222 Fremont Ave. N., Seattle 3, Wash.	1st	20
Robert Benns, 3802 Military Rd. N.W., Washington, D.C.	1st	12
Jon M. Martin, 7913 Sausalito Ave., Canoga Park, Calif.	1st	24
Kline H. Mengle, 401 Granville Dr., Silver Spring, Md.	1st	24
Gary D. Burnard, Johnson Rd., Kirkwood, RD #1, N. Y.	1st	12

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33A

Letter Tray

(Continued from page 10)

of no one but themselves; in fact, they seemed to take pride in clearing off the frequency. Transmitting over one another while trying to get signal reports was but one violation of the FCC rules. And when told by another station that they were causing a mess all over the band, they replied with rudeness and jeers. What I'm trying to get across is that improper and rude operation is not found *only* on the CB frequencies.

WENDELL DAVIS
Sanford, Fla.

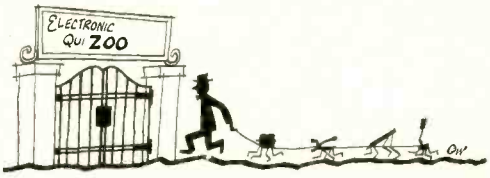
■ We agree that there are some CB'ers who abuse their privileges, but the most flagrant rule violators in our area—where over 30 CB'ers are operating—are those who have amateur radio licenses. The 80′ towers with four-element beams that readers Maass and Schumacher complain about are actually legal—provided they are used primarily for antennas other than CB antennas and that the CB unit does not add any height to the tower. As for QSL cards—there is no FCC regulation prohibiting the practice of exchanging these cards, so long as contact is made in accordance with other FCC regulations.

WALTER SCHULZE, 20W3947
JOHN H. COBB
Fredonia, N. Y.

Every story always has at least two sides, and so it is with CB'ers and hams. We doubt that there will ever be a time when violations of the FCC rules on either side of the fence will be completely eliminated, but there can and should be a sharp decrease in these violations. With the ranks of hams in excess of 200,000 and those of CB'ers greater than 300,000, the FCC has a lot of transmissions to check up on. And just as "you can't fool all of the people all of the time," you can't catch all of the violators all of the time either. Bob Jones's suggestion seems quite good to us—let the local CB or ham club know about any violations you come across, and the club should then do its best to remedy the situation.

Six Plus One for "Quizoo"

■ There probably wasn't enough room in "Electronic Quizoo" (October, 1962) to list all of the electronic parts that belong in such a "zoo," but



others which could have been mentioned include: SQUIRREL-cage motors, FLEA-clips, DUCKbill pliers, RAT-tail files, GOOSEneck microphone stands, and FISH-skin insulation.

ARTHUR MILES
San Diego, Calif.

And FLY-back transformers, too! —30—

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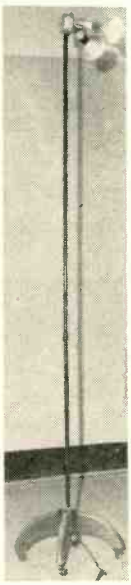
Tips and Techniques

SWIVEL-CHAIR BASE IS MOUNTING FOR FLOODLAMP



Can you use a portable floodlamp that will roll to any corner of your shop? You can make an efficient (if peculiar-looking) one from the base of an old swivel chair, a section of conduit, and a round electrical "wall box." Attach one end of the conduit to the center post of the chair base and mount the box on the other end. The box is fitted with a cover on which is installed a pair of swivel-type lamp holders, and a line cord is run up the conduit and wired to the holder. The cord should be of the heavy-duty type and long enough to give freedom of movement. If you wish, you can make a bracket from coat-hanger wire and fasten it to the conduit to keep the cord off the floor when it is not in use. Now just screw in a couple of floodlamps and you're all set.

—Wayne Floyd

SOLDERING POT FOR YOUR GUN TIP

A soldering pot, useful for tinning wire tips and lugs, can be devised for your soldering gun. Just wedge a small container, such as a discharged 22-caliber shell, between the heating elements of the gun, and you're all set. If a cartridge is not readily available, a large hollow rivet will probably do the job just as well.

—Jerome Cunningham

(Continued on page 20)

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Tips

(*Continued from page 14*)

PIN-POINTING DIAGRAM PARTS

Color-coded dressmaker's pins are very handy for identifying wires, parts, and connections on diagrams. Just attach the diagram to the wall or a piece of cardboard and stick the pins in. When building equipment you can identify parts or wires already soldered, and when servicing equipment the colored pins can mark the unsoldered parts or wires.

—John A. Comstock

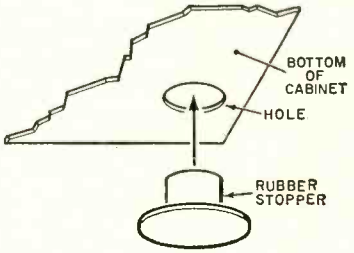
MAKE YOUR OWN PLUG-IN CAPACITORS

Capacitors that plug in like vacuum tubes make servicing and replacement easy. Although many commercial plug-in units are available, you probably have some loose capacitors around the shack that you can install in an octal plug yourself. Start out by mounting an octal tube socket on the chassis. Then insert the leads of the capacitors to be used in the circuit into the pins of an octal base—from an octal base and shield combination such as the Millen 74400—and solder them in place. Next, wire the corresponding socket pins into the circuit. Fasten the shield over the octal base, and your plug-in capacitor is ready to go.

—James V. Conklin

PRESS-FIT RUBBER FEET ON YOUR EQUIPMENT

Small flat-head rubber stoppers from medicine and chemical bottles are well suited to the task of protecting furniture against scratches from metal equipment cabinets. No screws are needed to install these plug-in rubber feet on your equipment. Drill a hole (slightly smaller



(Continued on page 22)

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	1DN5	.55		6AX4	.66		6SH7	1.02		12D4	.69
	1G3	.79		6AX5	.74		6SJ7	.88		12DE8	.83
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	1K3	.79		6BC5	.61		6SL7GT	.84		12DQ6	1.04
	1R5	.77		6BC8	1.04		6SN7	.65		12DS7	.84
	1S5	.75		6BE6	.55		6SQ7GT	.94		12DT5	.76
	1T4	.72		6BF5	.90		6T4	.99		12DT7	.79
	1U5	.65		6BF6	.44		6T8	.85		12DT8	.78
	1X2B	.82		6BG6	1.70		6U8	.83		12DW8	.89
	2AF4	.96		6BH8	.98		6V6GT	.54		12DZ6	.62
	3AL5	.46		6BJ6	.65		6W4	.61		12ED5	.62
	3AU6	.54		6BJ7	.79		6W6	.71		12EG6	.62
	3AV6	.42		6BK7	.85		6X4	.41		12EK6	.62
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	3DG4	.85		6BZ7	1.03		8BQ5	.60		12GC6	1.06
	3DK6	.60		6C4	.45		8CG7	.63		12J8	.84
	3DT6	.54		6CB6	.55		8CM7	.70		12K5	.75
	3GK5	.99		6CD6	1.51		8CN7	.97		12L6	.73
	3Q4	.63		6CG7	.61		8CS7	.74		12SF7	.69
	3S4	.75		6CG8	.80		8EB8	.94		12SK7GT	.95
	3V4	.63		6CL8	.79		8FQ7	.56		12SL7	.80
	4BQ7	1.01		6CM7	.69		9CL8	.79		12SN7	.67
	4CS6	.61		6CN7	.70		11CY7	.75		12SQ7GT	.91
	4DT6	.55		6CQ8	.92		12A4	.60		12U7	.62
	4GM6	.60		6CR6	.60		12AB5	.60		12V6	.63
	5AM8	.79		6CS6	.57		12AC6	.55		12W6	.71
	5AN8	.90		6CS7	.69		12AD6	.57		12X4	.47

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	5BQ7	1.01		6CY7	.71		12AF6	.67		18FX6	.53
	5BR8	.83		6DA4	.68		12AJ6	.62		18FY6	.50
	5CG8	.81		6DE6	.61		12AL5	.47		19AU4	.87
	5CL8	.76		6DG6	.62		12AL8	.95		19BG6	1.39
	5CQ8	.84		6DJ8	1.21		12AQ5	.60		19EA8	.79
	5EA8	.80		6DK6	.59		12AT6	.50		19T8	.85
	5EU8	.80		6DN6	1.55		12AT7	.76		21EX6	1.49
	5J6	.72		6DQ6	1.10		12AU6	.51		25AX4	.70
	5T8	.86		6DT5	.81		12AU7	.61		25C5	.53
	5U4	.60		6DT6	.53		12AV6	.41		25CA5	.59
	5U8	.84		6DT8	.94		12AV7	.82		25CD6	1.52
	5V6	.56		6EA8	.79		12AX4	.67		25CU6	1.11
	5X8	.82		6EB5	.73		12AX7	.63		25DN6	1.42
	5Y3	.46		6EB8	.94		12AY7	1.44		25EH5	.55
	6AB4	.46		6EM5	.77		12AZ7	.86		25L6	.57
	6AC7	.96		6EM7	.82		12B4	.68		25W4	.68
	6AF4	1.01		6EU8	.79		12BD6	.50		32ET5	.55
	6AG5	.70		6EV5	.75		12BE6	.53		35C5	.51
	6AH4	.81		6EW6	.57		12BF6	.60		35L6	.60
	6AH6	1.10		6EY6	.75		12BH7	.77		35W4	.42
	6AK5	.95		6FG7	.69		12BK5	1.00		35Z5	.60
	6AL5	.47		6FV8	.79		12BL6	.56		36AM3	.36
	6AM8	.78		6GH8	.80		12BQ6	1.16		50B5	.69
	6AQ5	.53		6GK5	.61		12BR7	.74		50C5	.53
	6AS5	.60		6GK6	.79		12BV7	.76		50EH5	.55
	6AT6	.49		6GN8	.94		12BY7	.77		50L6	.61
	6AT8	.86		6H6	.58		12BZ7	.86		70L7	.97
	6AU4	.85		6J5GT	.51		12CN5	.56		117Z3	.85
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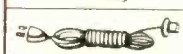

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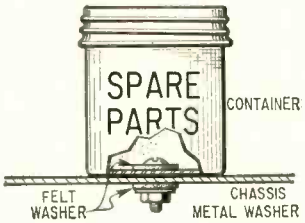
Tips

(*Continued from page* 20)

than the stopper diameter) in each corner of the chassis or cabinet, then insert the stopper for a tight fit.—*George Lodenquai*

BUILD IN SOME SPARE PARTS CONTAINERS

Ever spend frustrating "hours" digging up a replacement fuse for a power supply or a new pilot lamp for your receiver? With spare parts containers mounted right on the units themselves, you can save all this fuss and bother. Just get some plastic containers with screw-on caps, drill holes through the base of each plastic container and chassis, and bolt the container in place. Use a felt washer between the head of the screw and the base of the container, so that the plastic will be less likely to crack.



—*Martin J. Leff*

COMING NEXT MONTH

This half-finished stereo amplifier kit is sure to catch your eye—because it has no tubes! It's the Heathkit AA-21 all-transistor 100-watt integrated amplifier. You'll want to read all about this and similar units in our February issue.

ON SALE JANUARY 29

- **OPERATION ELECTRONIC ALERT** How much warning will we have of an enemy surprise attack? How effective are CONELRAD and NEAR? Don't miss this exclusive report!
- **REAR-VIEW MIRROR DIMMER** A night-time bright-light driver can provide more than one kind of headache. This clever dimming device is an automatic aspirin!
- **SOLID-STATE R.F. GENERATOR** You guessed it! A tunnel diode and a transistor team up to make this valuable piece of test gear.

Checklist for buying a full-power CB 2-way radio

look for these features:

☐ **TRANSMITTER POWER** — For longest transmission range possible, choose a 5 watt unit, the maximum authorized power input for Class D CB radios.

☐ **SENSITIVITY** — A greater sensitivity rating indicates a better ability to reproduce weak signals. Look for a sensitivity rating below 1 microvolt to capture signals transmitted many miles away.

☐ **SELECTIVITY** — A radio's ability to reject interference from channels not tuned in, is largely determined by the type of circuit used: superregenerative, superheterodyne or dual-conversion superheterodyne. The latter circuit, the dual-conversion superheterodyne, is acknowledged by experts to be the best circuitry for clearest reception. Says Len Buckwalter, noted communications author, in *Electronics Illustrated* May 1962. ". . . Look for the dual-conversion feature if you wish to get top receiver performance."

☐ **CRYSTAL-CONTROLLED CHANNELS** —Fixed crystal controls assure accurate, fast communications contact. They enable users to switch quickly from one channel to another to contact different persons, to find a channel that isn't busy. It is best to choose a CB unit with multiple crystal-controlled channels for an efficient, flexible 2-way radio system.

☐ **POWER SUPPLY** — A power supply should be an integrated part of a CB radio. Since full-power CB radios are most often used in vehicles and base stations, a CB radio's power supply should be able to operate from both a 12-volt auto battery and 110-volt AC line.

☐ **AUTOMATIC SQUELCH** — This automatically eliminates annoying background noise when a CB radio is on standby' (not transmitting and ready to receive any radio calls). Thus, hisses, crackles and other noises can't distract workers, drivers, etc.

☐ **AUTOMATIC NOISE LIMITER** — An effective automatic noise limiter is necessary, especially in heavily populated areas, to shut out extraneous interferences such as ignition noise. Makes messages more intelligible.

☐ **RELIABILITY**—CB radios must withstand vibration and shock which occurs during mobile use. Solid-state components—transistors and diodes—are less susceptible to damage than fragile tubes.

☐ **PORTABILITY** — Some full-power CB radios may be used in the field as portable units when equipped with a portable case-battery accessory. These units are generally lightweight, compactly designed and offer greater operating flexibility.

☐ **INSTALLATION**—Compact CB radios with simple mounting provisions don't steal leg room in vehicles, lower installation and maintenance costs.

Cadre Industries has two 5-watt models that rate high in every category. Each is supplied with a press-to-talk microphone, set of matched channel crystals, universal mounting bracket and AC & DC cords.

Cadre '510'
All-Transistor, 5-Watt, 5-Channel, plus all-channel manual Tuner, **$199.95**

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Hi-Fi Showcase

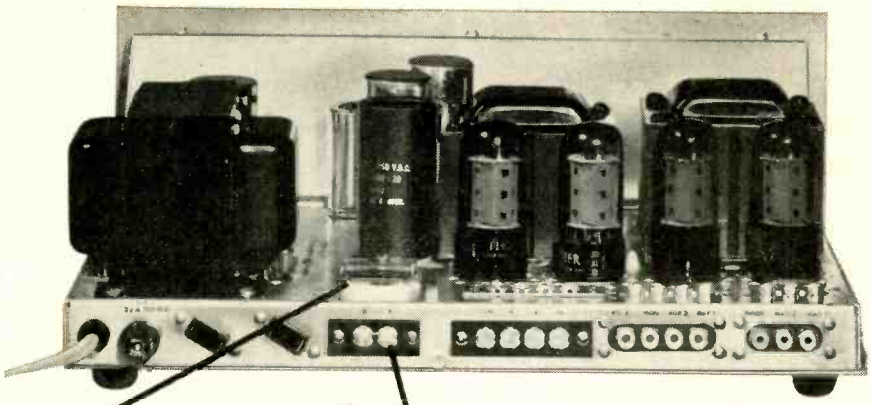
A quick look at new products in the stereo/hi-fi field*

WHAT'S IN STORE for the world of sound in '63? Better tapes and discs, better equipment all around, and some mighty striking innovations—among them, ***Fisher's*** MF-300, world's first FM tuner with remote control. Meters and tuning eyes are gone from the MF-300; in their place is a precision servomechanism circuit that automatically tunes to the exact center of the FM channel, far more accurately than manual tuning permits. How does it work? You push a button, left or right, as you choose, and there isn't a whisper from the speakers as the pointer moves across the dial toward the desired station. When it reaches that station, it stops at the precise point of maximum signal—automatically—and the selected station is heard immediately. An optional accessory, the RK-20 wireless remote control, even allows you to adjust volume and turn your entire system on and off from your favorite easy chair.

Thanks to ***Heath,*** you can now assemble your own two-keyboard electronic organ. The GD-232 kit gives you a choice of ten organ "voices," pedal control of bass volume, variable vibrato, and over-hanging keyboards. Equipped with its own built-in amplifier and speaker, the instrument comes with a hand-rubbed walnut cabinet so compact (it measures only 34½" x 39¾" x 21½") that it fits just about anywhere. Easy to build, the GD-232 is priced at $329.95; a matching bench is available for an additional $24.95 (both

Heathkit GD-232

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



1. Others don't have this.

2. Others don't have this.

3. Others can't have this.

Three points of superiority of the Fisher KX-200 StrataKit over all other single-chassis stereo control-amplifier kits:

1. Built-In d'Arsonval Meter. For easy, positive adjustment of bias and balance—with laboratory accuracy. Assures peak performance from the start; permits 'touching up' for continued peak performance throughout the years, regardless of tube aging. No other single-chassis control-amplifier kit has this vital feature.

2. Third-Speaker Output with Volume Control. Blends the two stereo channel outputs to feed a third loudspeaker system—at **any** desired volume level. Ideal for center-channel stereo fill-in or for a mono extension speaker in another room. Another Fisher exclusive among control-amplifier kits.

3. The Fisher Name. The inimitable Fisher exclusive. Your guarantee of a head start in kit building—before you even pick up your screwdriver.

And there is something **under** the chassis, too, that others don't have: StrataKit construction—assembly by totally error-proof stages (strata). Each stage corresponds to a **separate** fold-out page in the instruction manual. Each stage is built from a **separate** transparent packet of parts (StrataPack). Major components come already mounted on the extra-heavy-gauge steel chassis. Wires are **pre-cut** for every stage—which means every page. Result: Absolutely equal success by the experienced kit builder or the completely unskilled novice!

The KX-200 has a power output of 80 watts (IHFM Standard)—40 watts per channel. Harmonic distortion at rated output is 0.4%. The architectural brass-finish control panel is styled to match all other Fisher-built components. Price **$169.50*.**

The KX-100 StrataKit, an advanced 50-watt stereo control-amplifier kit with center-channel output, **$129.50*.**

The KM-60 StrataKit, world's most sensitive FM Stereo Multiplex wide-band tuner available in kit form, **$169.50*.**

The KS-1 three-way speaker kit, only Slim-Line loudspeaker system available in kit form, **$59.50**.**

FREE! $1.00 VALUE! The Kit Builder's Manual: a new, illustrated guide to high-fidelity kit construction.

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The Kit Builder's Manual

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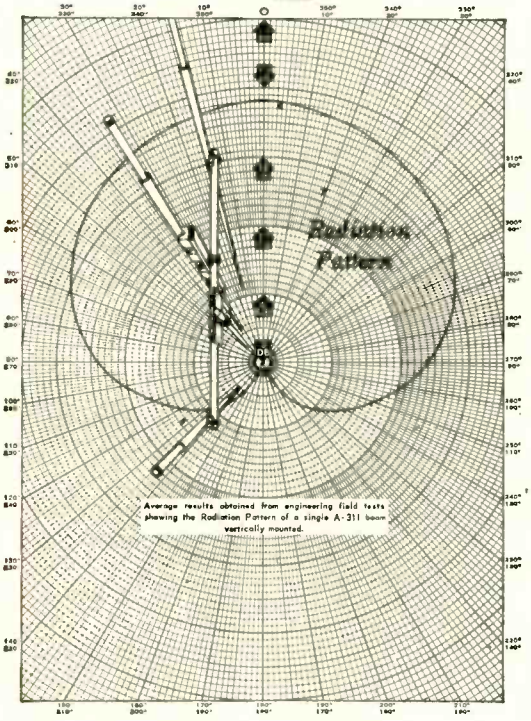
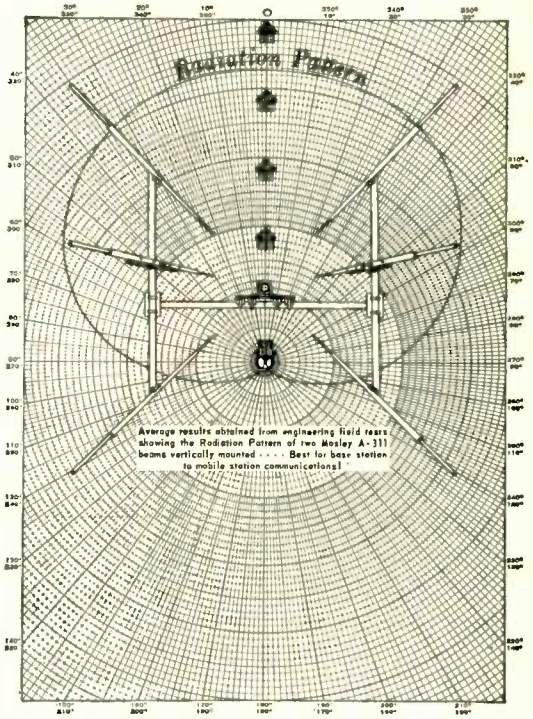
Why? STACK Your A-311 Beams....

.....Because! Stacking will attain the added gain necessary for improved performance and greater dependability for your CB communications.



A single A-311 beam, vertically mounted at "0" DB point, will give a gain in relative field strength of 8 DB over a reference dipole. This will increase the effective power of your CB transmitter to an equivalent of 32 watts.



A pair of A-311 beams, vertically mounted at "0" DB point, will give a gain in relative field strength of 11 DB over a reference dipole. This will increase the effective power of your CB transmitter to an equivalent of 63 watts. Connecting transformer & stacking cable included with A-311 stacking kit.

Dependable communications depend on the proper antenna system. Mosley produces high quality, top performance antennas that will assure you years of reliable service. Mosley antennas, such as model A-311, are built of noncorrosive and rust-proof materials. All aluminum is heavy guage 6061T6, hardware is stainless steel and associated parts are expertly molded of durable plastic. Mosley antennas are designed for 52 ohm impedance.

Mosley A-311, 3 Element Beam — List $46.88
Mosley A-311SK, Stacking Kit For Two A-311 Beams — List $68.21

Mosley Electronics Inc.
4610 N. LINDBERGH BLVD., BRIDGETON, MISSOURI

Showcase

(*Continued from page* 24)

prices are f.o.b. Benton Harbor, Mich.) . . . . A professional-quality, two-speed tape deck, ***Lafayette's*** RK-140WX comes complete with built-in transistorized stereo record/playback preamplifiers. Perfect for playing or recording 4-track stereo tapes, the unit boasts some outstanding specifications, including a signal-to-noise ratio of 45 db, interchannel separation of 45 db or better, wow and flutter content of less than 0.25% (at 7½ ips), and operation at both 7½ and 3¾ ips speeds. Supplied with all connecting cables and an empty reel, it also incorporates separate record-level meters, a tape index counter, an automatic cutoff switch, and a pause control. The RK-140-WX is priced at $99.50, with an optional portable carrying case (Model RK-145W) available for an additional $15.00. . . . A second product from Lafayette—this one an FM-stereo tuner kit—features a frequency response within 1 db from 20 to 20,000 cycles and a channel separation of 35 db at 400 cycles. All coils have been carefully prealigned at the factory, and construction is simplified with time-saving printed-circuit boards. An advanced type of "pilot monitor" tells you when a station is broadcasting FM-stereo, and a tuning indicator permits precise, on-the-nose tuning. Supplied with a gold front panel, a beige cover, and sienna-brown molded legs, the KT-660WX kit is priced at $84.50. . . . Still another Lafayette product—a 15" 3-way speaker—is custom built in England to Lafayette's rigid specifications. The Model SK-215WX's woofer section features an extremely low (25-cycle) cone resonance, and a plastic-terminated cone suspension. Overall frequency response is from 20 to 20,000 cycles; power-handling capacity, 50 watts; impedance, 16 ohms; and crossover frequencies are 2000 (mechanical) and 5000 (electrical) cycles. Price, $64.50.

Lafayette SK-215WX

A new integrated stereo amplifier by ***Merrell Electronics***—the Model SA-210—offers a peak power output of 16 watts per channel and has inputs for magnetic phono or tape, tuner, and crystal pickup. The amplifier features a dual volume/balance control and separate tone controls; its cabinet is finished in dull gold with an attractive black trim. In kit form (Model SA-210K), the amplifier is priced at $29.95; fully wired and tested (Model SA-210W), it sells for $49.95. The cover is an additional $4.95 in each case. . . . New from ***Norelco*** is the "Continental 401" four-track transistorized stereo tape recorder. Completely self-contained, the 401 includes two preamplifiers, two power amplifiers, and two speakers—one of which is in the removable cover to permit realistic stereo separation during playback. Because it's transistorized, the 401 requires no warm-up, so there's no reason for missing rare or once-in-a-lifetime "takes." Its fourth speed—$^{15}/_{16}$ ips—lets you record up to 32 hours on a standard 7" reel, and there are facilities for making sound-on-sound recordings. The 401 measures a compact 18½" x 15" x 10", weighs 38 pounds, and sells for $399.50. . . . A second four-track stereo tape recorder—this one the Model 997 by ***Roberts Electronics***—features six low-impedance stereo outputs; large, illuminated, studio-type vu meters; "motor-on" indicator lights; a "mute monitor speaker" switch; and simplified sound-on-sound recording. Other features include automatic shutoff and interlocking controls to prevent accidental erasure of recorded tape. Equipped with a hysteresis-synchronous, fan-cooled motor, the 997 will operate in either a vertical or horizontal position and offers speeds of 3¾, 7½, and 15 ips. Price, $449.95.

Norelco "Continental 401"

Olson's four-channel preamp/mixer is fully transistorized and battery-powered. There is a separate gain control for each input, and the unit also features a master gain control and a vu meter. The preamp/mixer (Model RA-501) carries a price tag of $29.98. . . . A second unit available from Olson, the RA-502 stereo/mono preamp/mixer, is similar to the RA-501 but is intended for stereo applications. Its vu meter can be switched to either stereo channel, and there are two master gain controls—one for each channel. Price, $34.98. . . . More than enough power to drive just about any speaker system is yours with ***Scott's*** Model 200 30-watt integrated stereo amplifier. Massive, heavy-duty transformers provide full power throughout the audio range;

Nothing fits all your CB needs like Hallicrafters' versatile new transistorized CB-5

Wherever and however you use citizens band, no transceiver made gets around with the effortless efficiency and consistent high performance of the new CB-5.

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A slim, matching pedestal will furnish AC power for base operation. And for carrying between "stations," it weighs just 6¾ pounds.

For occasional portable use, an inexpensive 12-volt battery works out fine; but we've also designed a highly-efficient rechargeable battery pak accessory, in case you're serious about it. (There'll be a tone-coded squelch accessory, too, in the near future.)

Specifications? Here are a few: 5 watts in; 100% modulation capability; 6 crystal-controlled channels; 1 μv sensitivity for 10 db. S/N ratio; 45 db. adj. channel rej.; PTT ceramic mike; 6 kc. selectivity at 6 db.; 18 transistors, 9 diodes, 3 instant-heat transmit tubes. Price: $199.95; accessories optional at extra cost. For full details, talk it over with your Hallicrafters dealer or drop us a line.

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5th & Kostner Aves., Chicago 24, Ill.

Overseas Sales: Contact Export Department, Hallicrafters. **Canada:** Gould Sales Co., Montreal, P. Q.

Showcase

(Continued from page 28)

separate bass and treble controls for each channel allow you to adjust for all types of program material. Other features: front-panel-mounted headphone jack, a tape monitor switch, and special inputs and outputs for the rambunctious tape-recording enthusiast. Price, $139.95. . . . Another item from Scott is the Model 55 stereo signal light. A completely assembled electronic device that mounts right on top of the chassis, the Model 55 automatically flashes on when your tuner is tuned to a stereo broadcast. Designed to update Scott's LT-110 FM-stereo tuner kits, Model 350 FM-stereo tuners, and LM-35 and 335 multiplex adapters, the Model 55 requires only five simple wiring connections—which you can make yourself or have done at any Scott service station for a modest fee. Price, $17.95 (more details in *Hi-Fi Lab Check*, p. 59). . . . A new stereo tape recorder available from ***United Audio*** has just about anything you could ever want in a portable tape system. The TG 12 SK can be used either by itself as a complete stereo system (it contains its own 10-watt amplifier and has inputs for either mono or stereo tuner, mike, and phono), or it can be plugged into an external stereo setup. A 4-track stereo/mono record and playback unit, it operates at 7½, 3¾, or 1⅞ ips, and even has provisions for making sound-on-sound recordings. The TG 12 SK comes equipped for automatic control of slide or movie projectors, and its two speakers—one in the top lid and one in the bottom—are easily removable for optimum stereo reproduction. The complete unit weighs only 32 pounds, carries a price tag of $349.95.

United Audio TG 12 SK

Fisher Radio Corp., 21-21 44th Dr., Long Island City 1, N.Y.
Heath Co., Benton Harbor, Mich.
Lafayette Radio Electronics Corp., 111 Jericho Turnpike, Syosset, L.I., N.Y.
Merrell Electronics Inc., 519 Hendrix St., Brooklyn 7, N.Y.
North American Philips Co., Inc. (Norelco), High Fidelity Products Div., 230 Duffy Ave., Hicksville, L.I., N.Y.
Olson Electronics Inc., 260 S. Forge St., Akron 8, Ohio
Roberts Electronics, Inc., 5920 Bowcroft St., Los Angeles 16, Calif.
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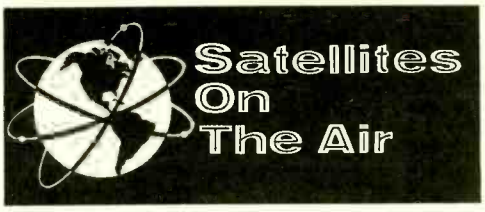


The following satellites, launched by the United States, were reported to have beacon and telemetry transmissions as of November 12, 1962. The satellites are listed by their code names, according to frequency; because some transmit on more than one frequency, they appear more than once.

Explorer VII*	19.990 mc.
Discoverer XXXVI	20.005 mc.
Transit IVA	54.000 mc.
Courier IB	107.970 mc.
TIROS I	107.997 mc.
TIROS III	108.000 mc.
Vanguard I*	108.024 mc.
TIROS III	108.030 mc.
Telstar	136.050 mc.
Explorer XV	136.101 mc.
Transit IVA	136.200 mc.
TIROS IV	136.230 mc.
TIROS V and TIROS VI	136.235 mc.
Ariel	136.408 mc.
Explorer XIV	136.440 mc.
Injun SR-3	136.500 mc.
Traac*	136.650 mc.
OSO I	136.744 mc.
Transit IVB	136.800 mc.
Anna	136.815 mc.
TIROS IV	136.920 mc.
TIROS V and TIROS VI	136.922 mc.
Alouette	136.979 mc.
Transit IVA	150.000 mc.
Transit IIA	161.990 mc.
Transit IIA	215.990 mc.
Midas IV	228.200 mc.
Midas IV	232.400 mc.

*Signal may be very weak

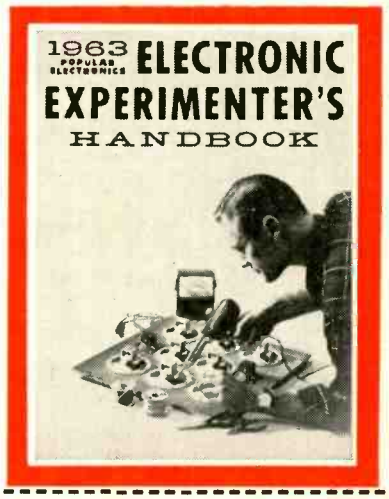
There are several more satellites in orbit and may be transmitting. However, these are so-called "secret" satellites launched by the U.S. Air Force.

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

pick projects like these to work on:

- Sweet Sixteen Goes Stereo
- Sound-Actuated Switch
- Two-watt Stereo System
- Double-Sideband Ham Rig
- Code Practice Oscillator
- CB Tone Squelch
- Radiation Fallout Alarm
- Auto Temperature Gauge
- Transistor Tester Tests All
- Neon Bulb Electroscope
- Transistor/Tube Broadcast Receiver
- Automatic Diode Checker
- No-license Broadcaster
- Transistorized Public Address System
- and Emily, the Electro-Mechanical Inebriated Ladybug Robot *(seen on the Jack Paar Show!)*

from the 1963 edition of



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PE 13

POP'tronics Bookshelf

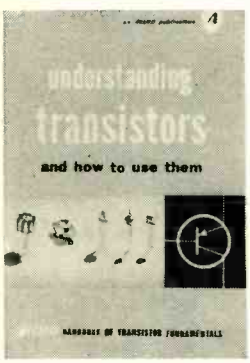
CITIZENS BAND 2 WAY RADIOS AND YOU

A practical guide on installing and operating CB equipment prepared by Globe Electronics, this book is well illustrated with diagrams, photos, charts, and tables. Topics covered include: how to achieve maximum range with a CB unit; ways to reduce noise; installation of all types of stations; and tuning and maintaining CB equipment. There's a comprehensive index at the very front of the book; and, just before the 24-page catalog section at the back of the book, there is a very useful glossary of "CB Lingo."

Published by Globe Electronics, 400 S. Wyman St., Rockford, Ill. 105 pages. Soft cover. $1.00.

UNDERSTANDING TRANSISTORS AND HOW TO USE THEM

This handbook is an excellent introduction to semiconductors for the student, hobbyist, and experimenter. Prepared by the Publications Division of Allied Radio Corporation, it covers the history and development of the transistor as well as its use in various circuits. Although emphasis is placed on the performance and capabilities of the many types of transistors in practical applications, a number of construction projects are also included. The latest addition to Allied's own library of electronic publications, the book is clearly written and well illustrated.



Published by Allied Radio Corp., 100 N. Western Ave., Chicago 80, Ill. 96 pages. Soft cover. 50 cents.

ELEMENTARY INDUSTRIAL ELECTRONICS (in two volumes)

by Leonard C. Lane

This two-volume set is intended as a detailed elementary course in industrial electronics. The two books are aimed primarily at the service technician, already familiar with electricity and electronics, as well as the trade school student. The technical vocabulary is kept quite simple, and the "mathematics" is nothing more than simple arithmetic. Among the wide variety of subjects covered are relays and switching, motor control, electronic heating, magnetic amplifiers, and instrumentation.

Published by John F. Rider Publisher, Inc., 116 W. 14th St., New York 11, N. Y. Two volume set, 344 pages. Soft cover. $7.80 per set.

ANTENNAS FOR CITIZENS RADIO SERVICE

by William I. Orr

Here's a "build-it-yourself" antenna handbook for CB'ers. After a general introduction to Citizens Radio and a few words about antenna theory, complete construction details are given on eight simple and inexpensive antennas for Class C and D licensees. The antenna types covered are demi-quad, dipole, "T" dipole, simple turnstile, ground plane, cobra, 3-element beam, and 5-element parasitic beam. Dimensional drawings accompany each project, and no basic knowledge of electronics is required to build or install any of these antennas.

Published by Radio Publications, Inc., Wilton, Conn. 40 pages. Soft cover. $1.00.

(Continued on page 37)

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Thanks to N.T.S. I have a business of my own right in my home. I have poid for all my equipment with money earned servicing TV sets. Yes, N.T.S. gave me my start in television.

Louis A. Tabat

As field director of Berean Mission Inc., I have complete chorge of our radio work. With the expert advice and training I am receiving from you I can do my own repairs on our recorders and P.A. systems, besides keeping our radios going. My training from N.T.S. helps keep us on the air. I feel privileged to be a member of such a fine institution.

Rev. Enoch P. Sanford

I have a TV-Radio shop in Yorkville, Illinois, about 4 miles from my home, and it has been going real good. I started part-time but I got so much work that I am doing it full-time. Thonks to National Technical Schools.

Alvin Spero

SEE OTHER SIDE

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PHASE 1 TELEVISION INCLUDING COLOR TV
90% of homes have at least one set. Color TV is becoming more popular daily. TV Stations grow in number, need technicians. Maintenance and repair offer big opportunities.

PHASE 2 RADIO—AM & FM
Radios in homes, cars, schools, all need expert upkeep. Stations expand as FM becomes popular. Now transistors boom entire field.

PHASE 3 INDUSTRIAL ELECTRONICS
Computers, Data-Processing machines, Electronic Controls, Guided Missile Systems are new fields where Electronics play a vital role.

PHASE 4 SOUND SYSTEMS
New popularity of Hi-Fi-Stereo, as well as industrial sound systems and business intercoms make this a highly specialized and important field.

PHASE 5 FCC LICENSE PREPARATION
FCC License holders have a wide range of top jobs open to them. FCC License now a requirement for most Communication jobs.

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These are the communications systems of the future, already used in tracking and cont acting satellites.

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Automation and Computer electronics are the new tools of industry and commerce. Skilled Technicians in these fields are in great demand at top pay.

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Bookshelf

(*Continued from page* 34)

FUNDAMENTALS OF MAGNETIC AMPLIFIERS

by Barron Kemp

A comprehensive introduction to saturable-core reactors and magnetic amplifiers is offered by this book. Because of their wide temperature range, low power consumption and versatility, these devices are increasingly being used instead of tubes in missile equipment, computers, and laboratory instruments. The six well-illustrated chapters begin with a discussion of the basic theory of the devices and conclude with several basic applications. Included in the back of the book is a glossary of terms common to the field of magnetic amplifiers.

Published by Howard W. Sams & Co., Inc., 1720 E. 38th St., Indianapolis 6, Ind. 128 pages. Soft cover. $2.95.

New Literature

A 12-page booklet entitled "What Does Minivac 601 Do?" is available from the Scientific Development Corp., 372 Main St., Watertown, Mass. It contains a detailed summary of the experiments and programs that are possible with the "Minivac 601" and the six instruction books which are provided with this digital computer simulator.

Supplied free with the 1963 catalog of Cisin's TV, radio, and hi-fi service books is a TV tube substitution guide and trouble-chaser chart containing 22 illustrations of picture faults due to defective tubes. To receive both catalog and chart, write to Harry G. Cisin, Publisher, Amagansett, N.Y., and include a stamped, self-addressed envelope.

"Audio Robots are for Sleeping" is the title of a 6-page pamphlet which discusses extension speakers in hi-fi systems and the ways in which automatic control can be accomplished from a remote point. For your free copy, write to Royce Electronic Developments, Inc., Dept. 33, P.O. Box 321, Valley Stream, N.Y.

Supreme Publications now supplies diagrams and maintenance information on individual radio and TV sets; the radio data on any one model is priced at 50 cents, the TV data at 75 cents. For a free 48-page list of available material, write to Supreme Publications, 1760 Balsam Rd., Highland Park, Ill. —30—

thanks to plug-in coils...

ONE RECEIVER ALL BANDS

By PHILIP E. HATFIELD, W9GFS
Receiving Tube Dept., General Electric Co., Owensboro, Ky.

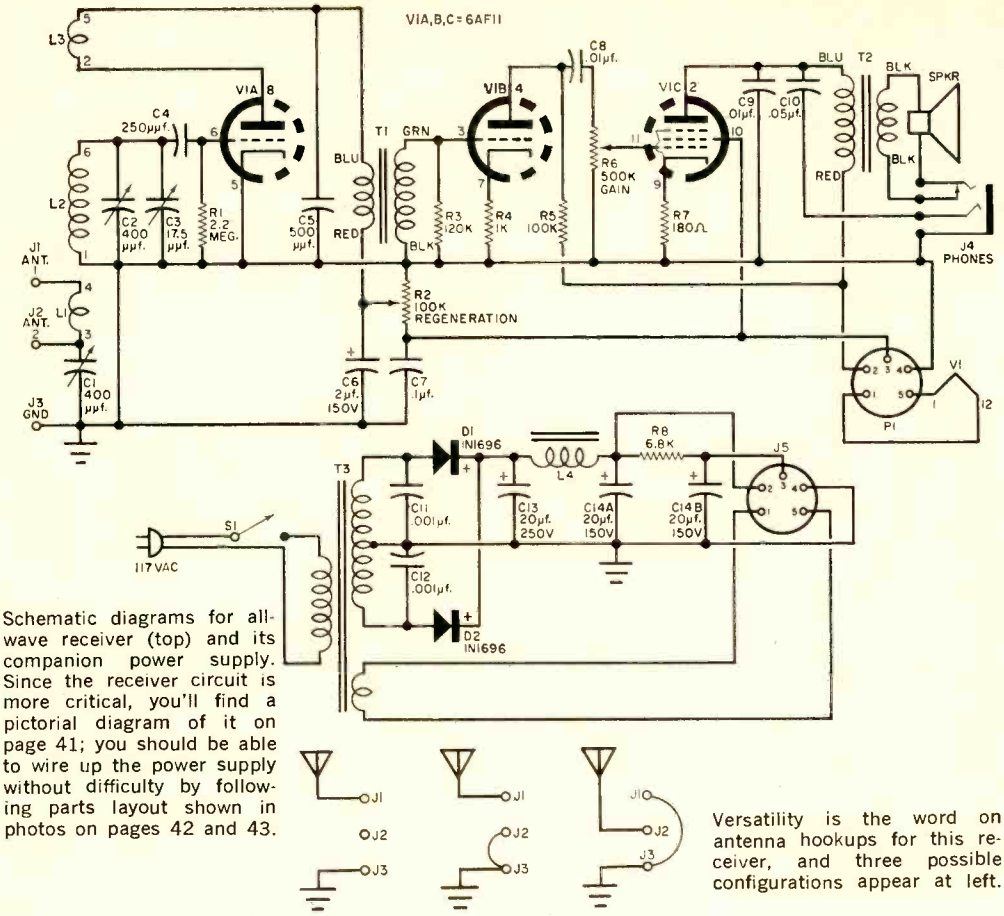
MOST of today's short-wave receivers are truly sensitive and reliable devices, but they are also rather complex and expensive for the beginner to construct. Here's a simple receiver, using one compactron tube, that will give you long-wave, broadcast-band, *and* short-wave reception. If you are considering putting your first receiver together, this one is for you. If you have an amateur-band-only receiver, this unit will fill in some of the "holes" in the spectrum. Finally, if you already have a general-coverage receiver, this set will make a good "auxiliary" to tuck away on a corner of the desk just in case your "big" one quits.

Use of a compactron allows a lot of receiver to be contained in a small box without undue crowding. The frequency range covered is from 250 kc. all the way to 16 mc.; and, since plug-in coils are used, it's possible to extend the range in either direction. Plenty of headphone volume is provided, and many signals will operate the built-in speaker in a very satisfactory manner.

The Circuit. The 6AF11 compactron contains two triodes and a pentode. One triode is used as a regenerative detector, the other as an audio voltage amplifier, and the pentode as an audio power amplifier.

Plug-in coils containing primary (*L1*), secondary (*L2*), and tickler (*L3*) windings determine the frequency range. Tuning is done with a relatively large variable capacitor (*C2*) to allow covering a wide range of fre-

COVER STORY

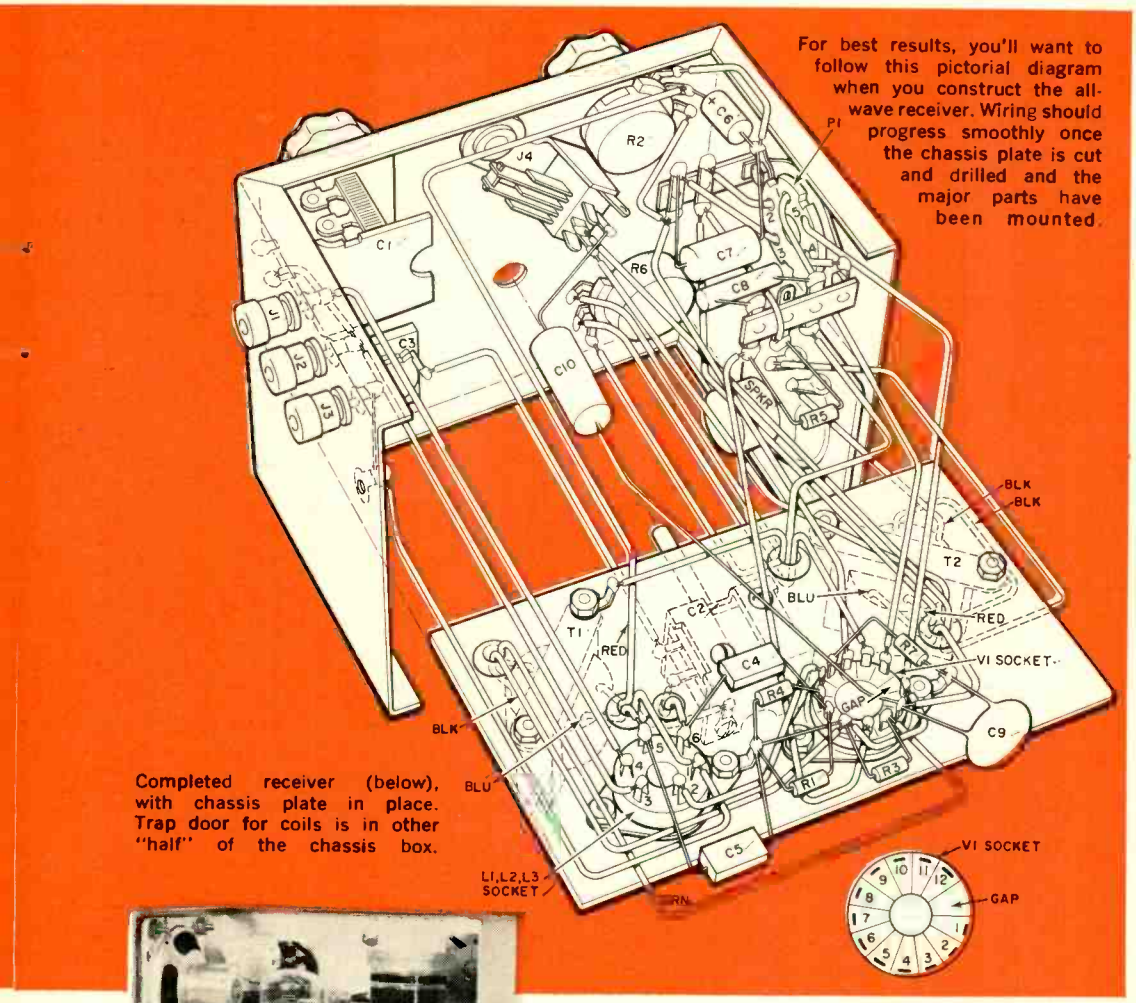


Schematic diagrams for all-wave receiver (top) and its companion power supply. Since the receiver circuit is more critical, you'll find a pictorial diagram of it on page 41; you should be able to wire up the power supply without difficulty by following parts layout shown in photos on pages 42 and 43.

Versatility is the word on antenna hookups for this receiver, and three possible configurations appear at left.

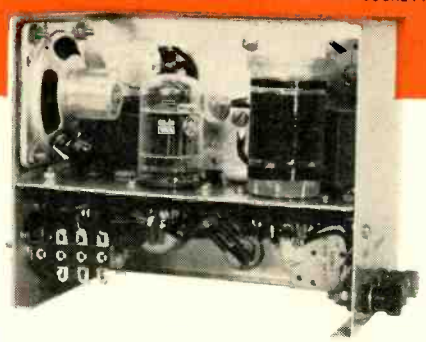
PARTS LIST

C1, C2—400-μμf. variable capacitor (Allied 61 L 009 or equivalent)
C3—17.5-μμf. variable capacitor (Hammarlund HF-15 or equivalent)
C4—250-μμf. mica capacitor
C5—500-μμf. mica capacitor
C6—2-μf., 150-w.v.d.c. electrolytic capacitor
C7—0.1-μf., 400-volt paper capacitor
C8, C9—0.01-μf., 1000-volt ceramic capacitor
C10—0.05-μf., 400-volt paper capacitor
C11, C12—0.001-μf., 1000-volt ceramic capacitor
C13—20-μf., 250-w.v.d.c. electrolytic capacitor
C14a/C14b—Dual 20/20-μf., 150-w.v.d.c. electrolytic capacitor
D1, D2—1N1696 diode
J1, J2, J3—Insulated binding post
J4—"Closed and transfer" phone jack (Mallory 703B or equivalent)
J5—5-prong socket
L1, L2, L3—Plug-in coil—see page 42 for details
L4—20-henry, 15-ma. choke (Chicago-Stancor C-1515 or equivalent)
P1—5-prong plug
R1—2.2-megohm, ½-watt resistor
R2—100,000-ohm potentiometer, linear taper
R3—120,000-ohm, ½-watt resistor
R4—1000-ohm, ½-watt resistor
R5—100,000-ohm, ½-watt resistor
R6—500,000-ohm potentiometer, audio taper
R7—180-ohm, 1-watt resistor
R8—6800-ohm, 1-watt resistor
S1—S.p.s.t. toggle switch
SPKR—2½" PM speaker, 3.2-ohm voice coil
T1—Interstage transformer, 1:3 turns ratio (Chicago-Stancor A-53 or equivalent)
T2—Output transformer: primary, 10,000 ohms; secondary, 4 ohms (Stancor A3879 or equivalent)
T3—Power transformer: primary, 117 volts a.c.; secondaries, 250 volts CT @ 25 ma. and 6.3 volts @ 1.0 amp (Stancor PS-8416 or equivalent)
V1—6AF11 tube
4—Six-prong coil forms, 1¼" in diameter, 2¼" long (Allied 71 II 724 or equivalent)
1—6" x 5" x 4" chassis box (LMB T-F781 or equivalent)
1—5" x 2¼" x 2¼" chassis box, gray hammertone finish (Bud CU-2104-A or equivalent)
4—6-pin sockets
Misc.—Dial, knobs, aluminum for chassis, wire for coils, hookup wire, socket for V1, line cord and plug, 5-conductor power cable with 5-pin socket and plug, hardware, solder, etc.



For best results, you'll want to follow this pictorial diagram when you construct the all-wave receiver. Wiring should progress smoothly once the chassis plate is cut and drilled and the major parts have been mounted.

Completed receiver (below), with chassis plate in place. Trap door for coils is in other "half" of the chassis box.

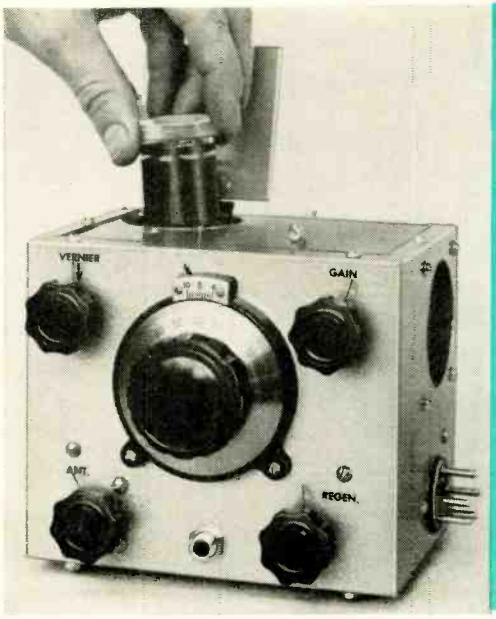


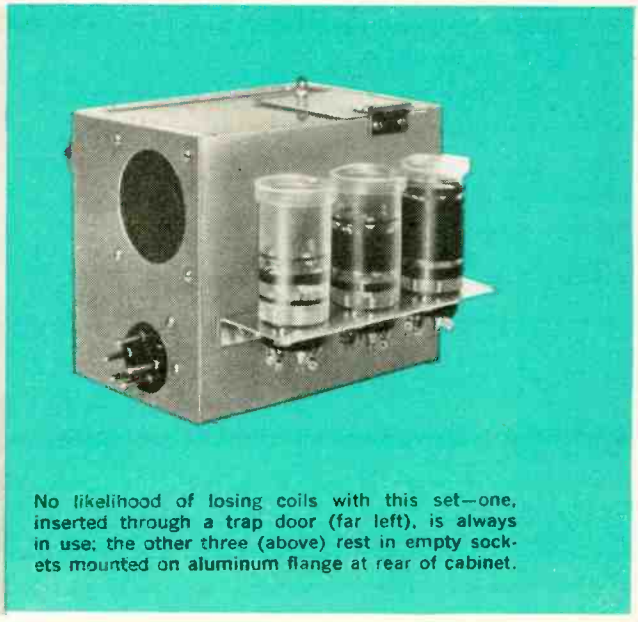
quencies with a minimum of coils. For fine tuning, a small variable capacitor (*C3*) is connected in parallel with the larger one to act as a "vernier."

The antenna coupling circuit is purposely designed for versatility. Straight inductive coupling, series tuning, or parallel tuning are possible, depending on the connections to jacks *J1*, *J2*, and *J3* (see antenna hookup diagram at left). This can be quite helpful in increasing the selectivity of the receiver and in tuning out the "dead spots" that afflict most regenerative receivers.

For maximum audio output, the headphones are operated from the pentode section of the compactron, and the phone jack (*J4*) is arranged to disconnect the speaker when the phones are in use.

The Receiver. All parts of the receiver, with the exception of the spare-coil rack, and the trap door for coil changing, are mounted on the portion of the chassis box used to form the front panel and sides. As the photos show, this makes all parts of the receiver readily accessible to the builder. In addition, since no electrical components are mounted on the removable portion of the box, all the testing that is necessary can be done





No likelihood of losing coils with this set—one, inserted through a trap door (far left), is always in use; the other three (above) rest in empty sockets mounted on aluminum flange at rear of cabinet.

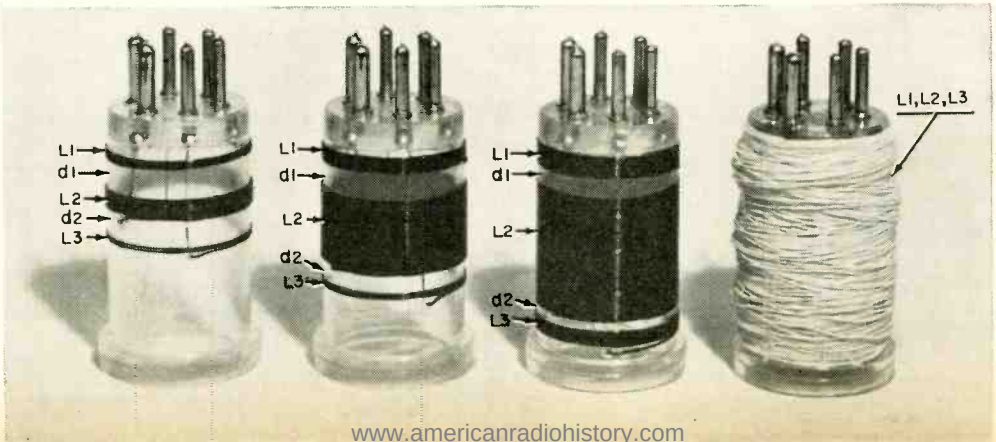
before the cabinet is "buttoned up."

To reduce sheet metal bending to a minimum, the chassis proper is a flat plate, cut to make a fairly snug fit, and then fastened in place with four small angle brackets. All mounting holes should be cut in this plate and the chassis box before the plate is bolted in place.

After the holes have been drilled, all of the parts should be mounted, since they are all readily accessible for wiring in any sequence. In mounting the 400-$\mu\mu$f. antenna tuning capacitor (*C1*), flat washers should be used between the panel and the capacitor frame to insure that the screws don't extend through the

Winding data for receiver's four plug-in coils appears below. All of them are close-wound, except for the long-wave coil (250-600 kc.) at far right; full information on how to wind this particular coil appears in text. Vary spacing (d2) on the first three coils by sliding L3 back and forth on the form until regeneration seems "smoothest," then apply cement to hold coils in place.

	4.8-16.0 mc.	*1.75-6.1 mc.*	*510-1750 kc.*	*250-600 kc.*
L1	5 turns #26 enameled	8 turns #26 enameled	18 turns #30 enameled	30 turns #28 DCC
d1	1/4"	3/16"	1/8"	
L2	8 turns #22 enameled	25 turns #22 enameled	100 turns #30 enameled	200 turns #28 DCC
d2	1/4"	3/16"	1/16"	
L3	3 turns #26 enameled	4 turns #26 enameled	8 turns #30 enameled	10 turns #28 DCC



All-wave receiver and its power supply, ready for use. Since power requirements are comfortably low (about 150 volts d.c. @ 25 ma., and 6.3 volts a.c. @ 1.0 ampere), you may be able to "steal" the power from an existing receiver or amplifier and thus save yourself the trouble of building a separate supply.

frame far enough to interfere with the rotor.

Wiring of the receiver isn't especially critical, and the receiver is compact enough to allow component leads to furnish many of the connections. However, be careful to wire the coil socket exactly as shown, since proper wiring here is just as important as on the tube socket.

The Power Supply. A separate entity, the power supply is built on a 5″ x 2¼″ x 2¼″ chassis box. Holes for the various parts should be drilled in the box and all parts mounted before any wiring is done. Again, the wiring isn't critical, although care should be taken in connecting leads to the output socket (*J5*) to make sure that the proper socket contacts are used.

The power cable which connects the power supply to the receiver is made from a length of five-conductor, plastic-covered cable. This cable allows the power supply to be placed in some convenient spot away from the receiver. If the plastic-covered cable isn't available, individual stranded insulated wires can be used to make the cable, with bands of tape fastened at intervals to keep it together. Be sure that the wires used for the heaters are at least #20 gauge. Before testing the receiver, double-check to see that all of the plugs and sockets are correctly wired so that the voltages from the power supply arrive at the right points in the receiver.

The Coils. Before the receiver can be tested, at least one of the plug-in coils must be wound. Start with the broadcast coil, since it covers the range where results are easiest to obtain.

The polystyrene forms will call for some cautious handling—when drilling, too much pressure may crack them; and, when soldering, excessive heat will soften them. Lightly filing the ends of the coil form pins to remove the plating will make soldering easier. Remember, rapid soldering is required to prevent softening of the form. Start by winding the primary, followed by the secondary, and then the tickler.

One way to make a neat job is to push the wire through the starting hole in the form and into the pin and then solder it in place. Then unwind the amount of wire from the spool that you think will be required, but don't cut the wire just yet. Instead, clamp the spool in a vise and walk away until the wire is under slight tension.

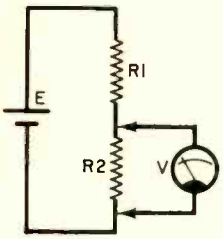
Wind the coil by turning the coil form in your hands as you walk slowly toward the vise. If you have underestimated the wire needed, or if your workshop is small, hold the coil in one hand to prevent the wire from slipping, remove the

(*Continued on page* 118)

ELECTRONIC MEASUREMENT QUIZ

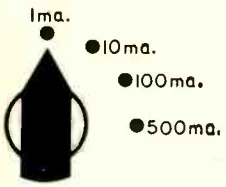
By ROBERT P. BALIN

Think you know how to use and care for meters? Then test yourself on the statements below and compare your answers with those on page 110.



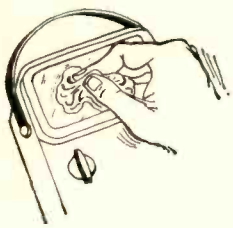
1 To reduce "loading" effect of a voltmeter, set it on the highest voltage range producing a readable indication.

TRUE FALSE



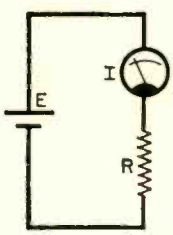
2 Before carrying a VOM, set it on its lowest current range.

TRUE FALSE



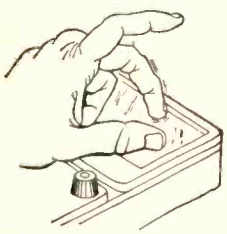
3 Cleaning a meter face with a dry cloth may reduce reading accuracy.

TRUE FALSE



4 Use an ammeter's lowest current range during readings to keep meter's internal resistance to a minimum.

TRUE FALSE

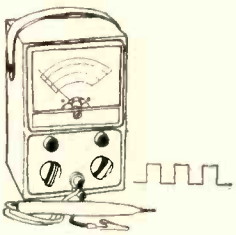


5 Tapping a meter face as pointer is moving helps get a more accurate reading.

TRUE FALSE

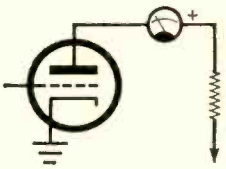
6 Most voltmeters read only sine waves of a.c. voltage correctly. Square waves will cause a meter to read low.

TRUE FALSE



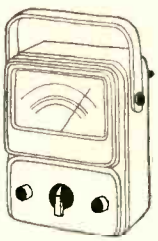
7 Ammeter is installed properly when its + terminal connects to the B+ supply.

TRUE FALSE



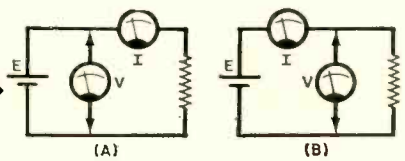
8 A technician can guarantee a voltage reading to the greatest degree of accuracy when he selects a range that places the reading as far up scale as possible.

TRUE FALSE



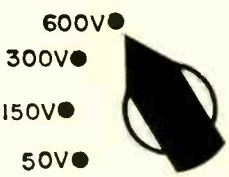
9 When measuring low resistance, the voltmeter-ammeter method shown in circuit (A) should be used.

TRUE FALSE



10 When measuring an unknown voltage, start with the highest voltage range available, then step down to the range producing a readable indication.

TRUE FALSE



SMALL FRY STEREO

By HOMER L. DAVIDSON

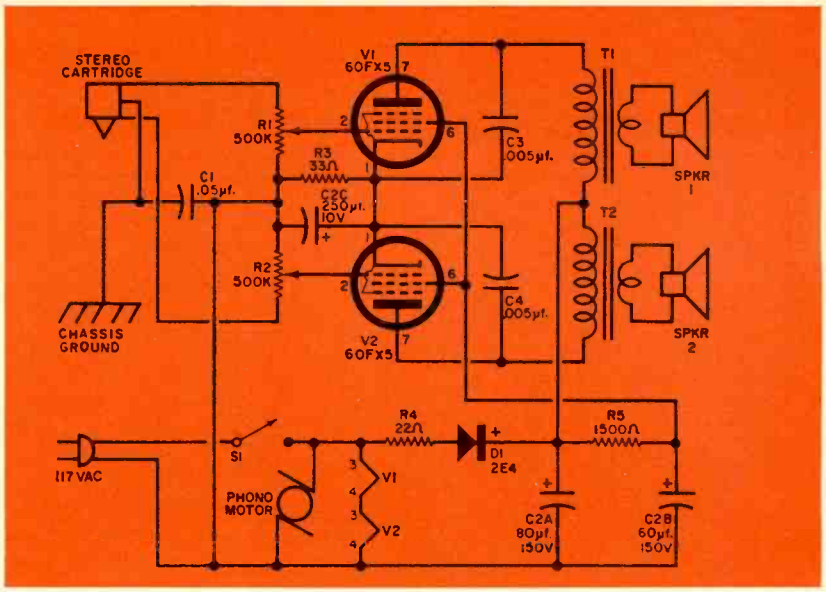
No frills or special twists to this one—
just a straightforward little a.c./d.c. amplifier
that's perfect for a child's portable phonograph

WHAT'S THAT you say? You have an old portable phono around the house but it's monophonic and won't play stereo? Well, let's dig it out and update it with this little stereo amplifier. You're certain to delight the small fry in your family, and you'll find the amplifier a cinch to put together. Since the complete unit is very much on the compact side, you should have no trouble installing it in that old portable (or even placing it in a brand-new phonograph case you've purchased for the purpose). Only two tubes are used—one for each channel, and the circuit is simplicity in itself!

In the author's case, an old monophonic player was converted to stereo, and he began by removing the mono cartridge and installing a stereo cartridge in its place (using the necessary stereo phono cable, of course). However, since many of the older players put plenty of "poundage" on the stylus, it might be better in the long run to pick up an inexpensive stereo arm-and-cartridge combination. Naturally, if you're starting from scratch, you'll be purchasing a stereo arm and cartridge to begin with.

A glance at the circuit reveals a volume control in each control grid lead, and, in the author's phono, volume of the two channels is con-

SMALL FRY STEREO

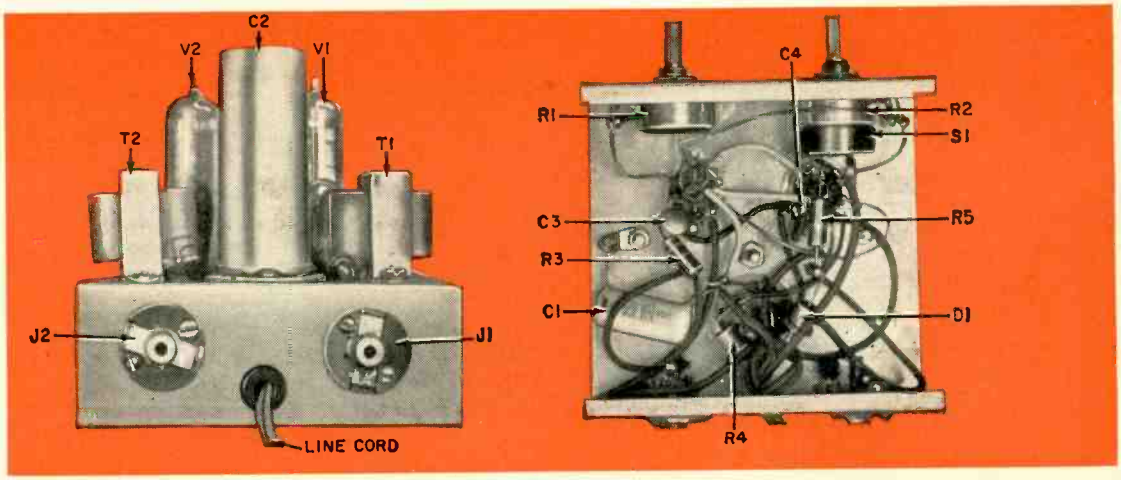


Circuit diagram of "Small Fry Stereo." Author installed phono jacks (J1 and J2 in photo below) between output transformer secondaries and speakers, but jacks can be eliminated and leads run directly to speakers, as shown here.

trolled independently. However, there's no reason why *you* couldn't use a ganged control, since channel balance isn't too important with such a simple hookup. In any event, you will need an s.p.s.t. switch (*S1*), which can either be mounted on the volume control(s) or as a separate entity. Note that this switch will control both the motor and the amplifier if wired as shown—a second s.p.s.t. switch to control the phono motor alone might be a worthwhile addition.

The two 60FX5 power pentode tubes which form the heart of the circuit are fairly new on the market and have much to commend them. This tube has a high power sensitivity and provides a power output of a little over a watt from a crystal or ceramic stereo cartridge—ample volume for the kids. And, thanks to the 60-volt heater, two such tubes can simply be connected in series across the 117-volt line. The power supply can be an inexpensive half-wave rectifier, as it is here.

Construction. There isn't anything critical about the way in which the parts should be mounted. But the simplest way is also the best—just lay out the components for each channel in a straight line on the chassis, and wire them up. The tubes can be mounted at



PARTS LIST

C1—0.05-μf., 200-volt paper or ceramic capacitor
C2a/C2b/C2c—80/60/250-μf. can-type electrolytic capacitor, 150/150/10 w.v.d.c. (Sprague PCL-3414.3 or equivalent)
C3, C4—0.005-μf., 600-volt paper or ceramic capacitor
D1—2E4 silicon diode (or equivalent)
J1, J2—RCA phono jack
R1, R2—500,000-ohm potentiometer, audio taper
R3—33-ohm, 1-watt resistor
R4—22-ohm, 1-watt resistor
R5—1500-ohm, 1-watt resistor
S1—S.p.s.t. switch
SPKR 1, SPKR 2—4" PM speaker, with 3.2-ohm voice coil
T1, T2—Audio output transformer: primary, 2000 ohms; secondary, 3.2 ohms (Stancor A-3332 or equivalent)
V1, V2—60FX5 tube
Misc.—Tube sockets, chassis, line cord and plug, phono motor and arm with stereo cartridge, cabinet, wire, solder, hardware, etc.

the front (just behind the volume controls), capacitor *C2* placed between the two output transformers, and standard RCA phono jacks installed for easy connection of the two speakers.

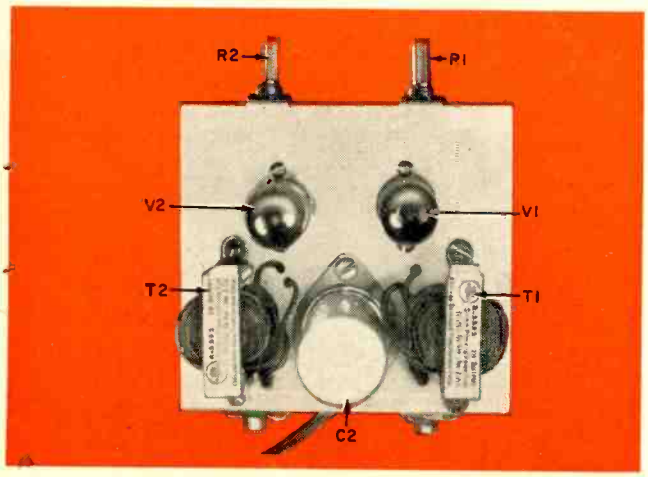
The wiring is straightforward and can easily be finished in a matter of minutes. Since the tubes are located close to the volume controls, the leads to the control grids are very short, and there is no noticeable hum pickup as the control settings are increased.

The common "ground" tie point is the insulated negative terminal of the electrolytic capacitor (*C2*). Run all ground leads to this terminal, then bypass it to the chassis with 0.05-μf. capacitor *C1* (don't forget to connect the "middle" or ground terminal of the stereo cartridge to the chassis as well). The only time you'll have to use a heat sink, incidentally, is when soldering the diode (*D1*) in place. Be sure to observe polarity with *D1*, and take care to wire the three sections of capacitor *C2* as indicated.

Stereo Speakers. Naturally, you'll need two speakers for the "Small Fry Stereo," and you can suit yourself as to exactly where and how you mount them. The author was content to simply install an extra 4" PM speaker in the lid of the case, which, in this particular instance, happened to be removable. If the cover of your case isn't detachable, you can probably alter the hinges in such a manner that the lid can be removed and set alongside the main unit for better stereo separation.

To test out the "Small Fry Stereo," plug the leads from the two speakers into their respective jacks and fire up the unit. The tubes should light in a few seconds, and "thumbing" the stylus should bring a "scratching" sound from the speakers.

If everything checks out okay thus far, place a stereo record on the turntable, turn up the volume, and sit back and listen (if you've used separate volume controls you'll have to adjust both controls until you achieve proper balance). Assuming you've done the job carefully, you'll find there's plenty of volume for a small fry, and that the stereo quality is quite good, too. —30—



Rear, bottom, and top views of amplifier (from left to right) show placement of every major component. Switch S1 was ganged to potentiometer R2 in author's unit, but you may decide to install it elsewhere. And don't be confused by the fact that J1 and J2 are standard phono jacks: they were installed for connecting up the speakers—not the stereo cartridge, as you might expect.

AMVER + RAMAC

How 55 nations and 1 electronic computer help prevent

IN A SINGLE YEAR, courage, seamanship, and an IBM computer rescued 159 men from almost certain death in the North Atlantic. This impressive record was chalked up as the U.S. Coast Guard's AMVER program went into its fifth year—with 55 seafaring nations now participating.

What is AMVER, and how did an electronic computer get into the search and rescue business? The term "AMVER" stands for *A*tlantic *M*erchant *V E*ssel *R*eport, a program in which merchant ships of many nations voluntarily take part in order to increase safety on the Atlantic Ocean. Upon beginning a voyage in the off-shore areas north of the equator and west of the prime meridian, a ship radios its name, call sign, position, route, speed, and destination to the AMVER center in New York City.

Enter the IBM 305 *RAMAC* computer. Located in New York, it sits like a spider in the center of a communications web strung from the Gulf of Mexico through the Caribbean and north to Newfoundland and the ocean station vessels on their lonely North Atlantic beats. Information from the reporting merchant ship is fed into *RAMAC* and stored along with information on 14,000 other ships that regularly cross the Atlantic Ocean.

Let's see what happens when a ship or aircraft is in distress.

Seaplane In Distress. On September 22, 1961, a large Navy seaplane crashed into the sea 160 miles north of Bermuda without being able to send a distress call. When the seaplane became overdue, an air search was launched. Eventually, three survivors were spotted on a raft, at the mercy of heavy seas and high winds. An immediate rescue by ship was necessary, but which of approximately 800 ships then under plot in the Atlantic would be best situated to pick up the fliers?

AMVER Rescue Coordination Center in New York City (far left) is but one of five such centers in the eastern U.S. which supply information to and receive information from the IBM 305 RAMAC computer operated by the U.S. Coast Guard. At left, an AMVER watch operator dictates notes into a tape recorder to keep AMVER's log up to date.

U.S. Coast Guard photos

=RESCUE

By SCOTT GIBSON

disaster throughout the North Atlantic

The position of the raft was radioed to New York and fed into the IBM computer. *RAMAC,* computing with incredible speed the approximate positions of all of the 800 or more ships carried in its "plot" at that time, quickly predicted that the *SS African Pilot* was in the area. The Coast Guard radio station in Bermuda called the merchant ship directly and advised its master of the situation.

The *African Pilot* immediately turned and raced to the scene. Its crew launched a boat at considerable risk in the high seas, and the fliers were picked up safely. Three more men owed their lives to the uniquely effective coordination of rescue equipment made possible by AMVER.

"Medico" Rescues. The Coast Guard is proud of the international enthusiasm for AMVER. Every month more ships join this strictly voluntary program. The Coast Guard emphasizes that it has no authority over foreign merchant ships; it isn't needed, anyway, for help has never been refused. The international aspects are illustrated in the following "medico" rescue.

In January of 1961, the electrical officer of a Dutch tanker, the *SS W. Alton Jones,* became gravely ill with abdominal pains when his ship was halfway between Nassau and Bermuda. Emergency medical advice radioed from the U. S. Public Health Service recommended immediate attention by a doctor. When the AMVER center was contacted, its "surpic" (surface picture) showed that the Swedish liner *SS Gripsholm* was probably the only "doctor ship" in the general vicinity.

The tanker radioed the *Gripsholm,* the ships made rendezvous, and surgery was immediately performed for acute appendicitis. The ship's sur-

Operator at console of RAMAC electronic computer instructs machine to locate and type out information previously stored on magnetic "memory" tracks.

U.S. Coast Guard photos

Technical assistant enters a modification to the big computer's program. Frequent improvements have resulted in stepped-up life-saving capabilities.

geon stated that an additional half hour's delay would have been fatal!

RAMAC not only stores vast quantities of data but it can use this information in a number of ways. The names, call signs, positions, courses, and speeds of merchant vessels in any designated area at any given time can be quickly produced. The computer is frequently asked to show what "doctor ships" are within, say, a hundred-mile radius of a ship requesting medical aid, as in the last example. If there are no ships in the area at the moment carrying doctors, the computer will state whether such ships are scheduled to enter the area later.

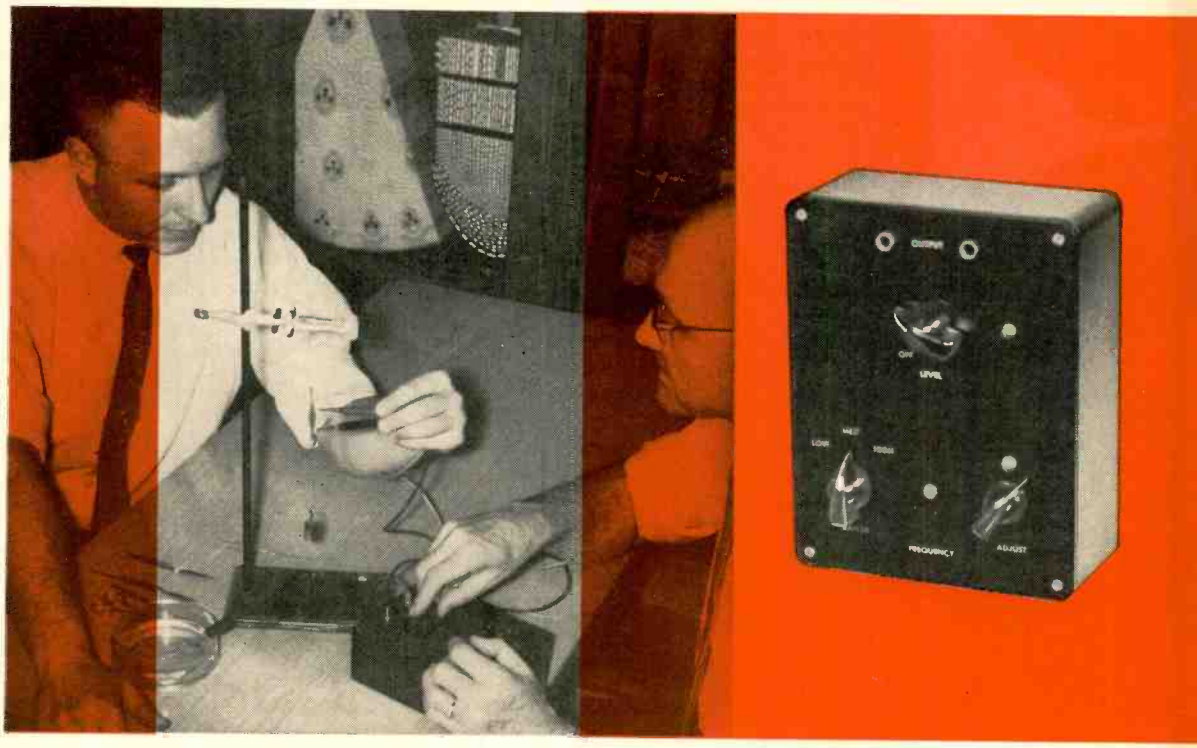
"Track Search." Sometimes, when a plane is missing and there is no indication of its position, the computer is asked to help out in a "track search." Air control authorities usually know the geographic course or "track" the aircraft was scheduled to travel, and *RAMAC* produces the names of all reported ships within, say, 50 miles of both sides of the track. These vessels can then be requested to search the area, which may be far too large for Coast Guard and military units to handle alone.

Ships standing by a vessel in danger but not requiring immediate rescue can be relieved of their duty when the surface picture shows that other vessels will soon arrive. Or the best situated of a number of rescuers answering a distress call will be shown and the others can resume normal sailing with clear consciences.

Precautionary Plotting. Not all of the AMVER work is as dramatic as you might think. In fact, most "surpics" are obtained as a precaution against potential distress situations. A ship may radio in a report of a mysterious flare burning at night, unidentified flotsam in the water, or even a U. S. astronaut circling the globe. In each case, "surpics" are routinely prepared. If the situation should become an emergency, rescue work will begin immediately with a full knowledge at hand of available merchant ship aid.

In 1961, a total of about 60,000 ship passages were plotted from reports received from ships of 55 nations, and the number of participants increases every year. The Atlantic Ocean is still far from tamed, but AMVER is an electronic link in the chain of human courage and skill that will someday bind the "watery demon." —30—

AN ELECTRONIC PROJECT for STUDENT BIOLOGISTS



THE NERVE STIMULATOR

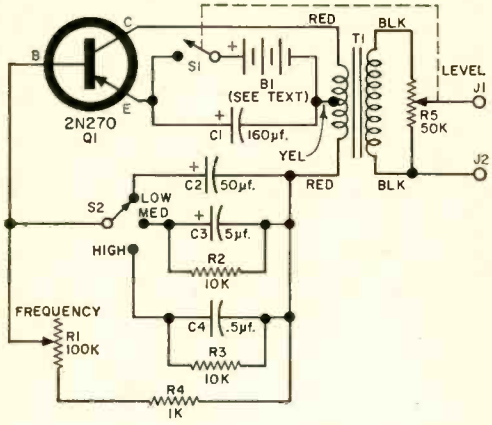
Simple pulse generator will prove useful in the classroom, biology lab, or on your workbench

By JAMES E. PUGH, Jr.

CHANCES ARE someone discovered that electricity could be a very effective muscle and nerve stimulator on the day the first man was struck by lightning. But no practical use was made of this effect until after Luigi Galvani demonstrated (late in the 18th century) that the muscles in a frog's leg could be made to twitch when an electric current was applied. Since then, there has been considerable progress in harnessing electrical currents for man's physical and mental welfare.

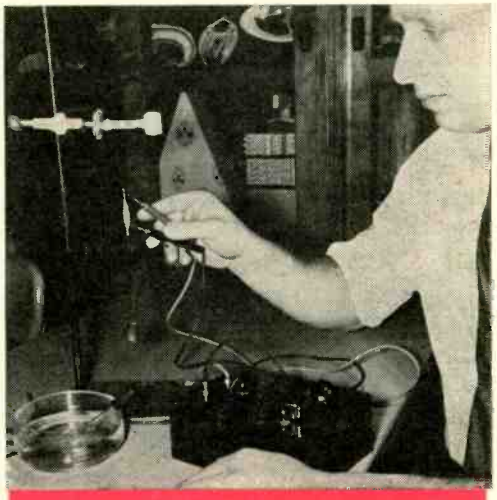
While there are many ways that electricity is used in these areas, here we are primarily interested in the application of low-frequency potentials direct to the tissue (in contrast to the application of high frequencies through radiation).

Such low-frequency potentials of the proper waveform, frequency, and intensity are now being used by surgeons to differentiate between nerves



Above: schematic diagram of the nerve stimulator. Switch S2 controls the pulse rate, and potentiometer R1 governs the frequency.

Below: a laboratory technician applies the nerve stimulator's probes to a frog's leg in classroom demonstration.



A word about the Nerve Stimulator

This instrument is intended primarily for use in classroom or laboratory, and then only under the supervision of an instructor. It is potentially dangerous and must be viewed not as a toy, but as a device for illustrating an important biological principle. Handled with discretion, and used for the purposes it is intended for, the stimulator will prove to be a highly educational project.

PARTS LIST

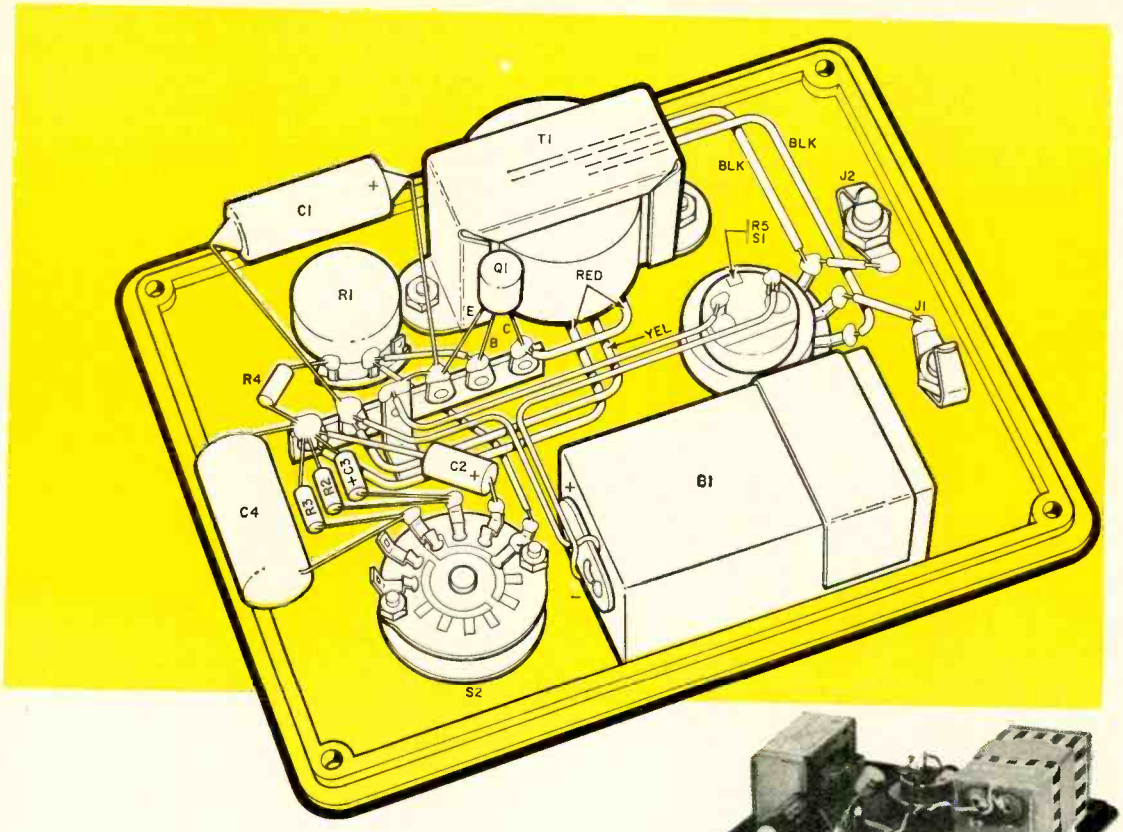
B1—1.5- to 9-volt battery—see text
C1—160-μf., 15-w.v.d.c. electrolytic capacitor
C2—50-μf., 25-w.v.d.c. electrolytic capacitor
C3—5-μf., 25-w.v.d.c. electrolytic capacitor
C4—0.5-μf., 200-volt paper capacitor
J1, J2—Tip jack
Q1—2N270 transistor (RCA)
R1—100,000-ohm potentiometer, log taper
R2, R3—10,000-ohm, ½-watt resistor
R4—1000-ohm, ½-watt resistor
R5—50,000-ohm potentiometer, linear taper (with s.p.s.t. switch S1)
S1—S.p.s.t. switch (on R5)
S2—1-pole, 2-11-position, shorting rotary switch (Centralab PA-1000 series or equivalent)
T1—Filament transformer: primary, 117 volts a.c., secondary, 6.3 volts CT @ 1.2 amperes (Stancor P6134 or equivalent)
1—6 13/16" x 5 9/32" x 2 5/32" plastic instrument case (Davies 260 or equivalent)
1—6" x 3 1/2" cover for above (Davies 261 or equivalent)
3—Pointer knobs
4—4-36 x ½" flat-head machine screws
3—6-32 x ¼" flat-head machine screws and nuts
1—6-lug terminal strip
2—Cables with tips and electrodes—see text
Misc.—Decals, wire, solder, etc.

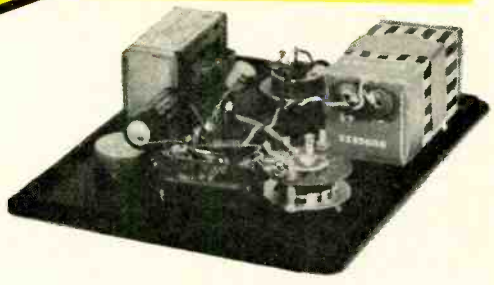
and muscles. The reason: nerve trunks respond to lower voltage impulses than muscles. As a result, it's possible for surgeons to preserve the invaluable nerve trunks during delicate facial operations, for example.

The physical therapist uses electrical currents to identify normal and denervated muscles. In addition, he can "re-educate" muscles in weak and useless limbs through electrically activated muscular contractions.

On the other hand, the biologist, medical student, and research worker often investigate the effect of electrical stimuli on both human and animal tissues. For such applications, a portable stimulator operating from inexpensive batteries is very desirable. And the economy in size, weight, and power consumption of the transistor makes it outstanding as the generator of some of the electrical currents required.

The transistorized instrument shown here is intended primarily for classroom demonstration. It generates a series of short, fast-rising pulses that are continuously variable in frequency from about 1 to 2500 pulses per second. The output level is adjustable from zero to





Entire circuitry of the nerve stimulator is mounted on the cover of a Bakelite instrument case. Wiring is straightforward, but potentiometer R1 should be connected so that it has a "counterclockwise" taper.

about 150 volts under a normal load.

In addition to its use in the classroom, this instrument can be employed by the electronics experimenter as a general-purpose pulse generator. Its wide range of pulse rate and amplitude makes it suitable for many projects.

Construction. The stimulator is housed in a Bakelite instrument case with matching cover that overlaps the sides for an attractive appearance. All parts, including the battery, are mounted on the cover; careful attention to placement of the heavier items will give a good weight distribution for easy handling.

When drilling the cover, back it with a flat strip of wood to help prevent chipping. Also, make the holes slightly undersize and then carefully enlarge them to size with a ½" tapered reamer. The sharp edges of all holes can then be smoothed off slightly with a countersink of the tapered end of a large drill to obtain a neat job and avoid any possibility of chipping when the parts are mounted.

The job is now nearly done. All that remains is to mount the parts, dress the leads to size, and secure all joints carefully with rosin core solder. Use a minimum of solder on the contacts of switch *S2*, and use a heat sink when soldering the transistor and electrolytic capacitors. Label the controls with decals and apply a coat of wax to the case to help preserve its smooth finish.

How It Works. The stimulator is a simple battery-operated pulse generator. With the collector of transistor *Q1* con-

(*Continued on page* 101)

Eliminate misfires caused by tired cells and let an a.c. outlet supply power to fire your flash gun for indoor snapshots

Battery Eliminator for Flash Guns

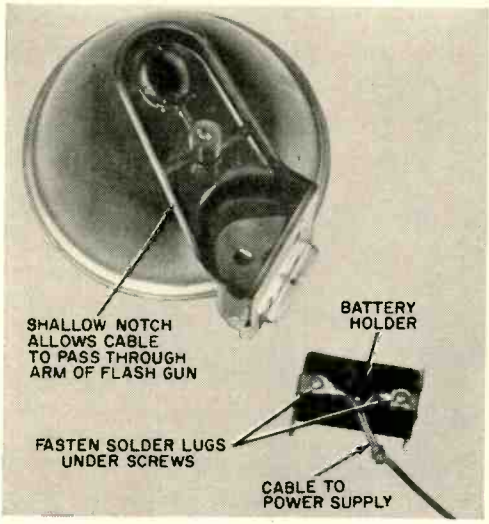
By S. D. HUGHES

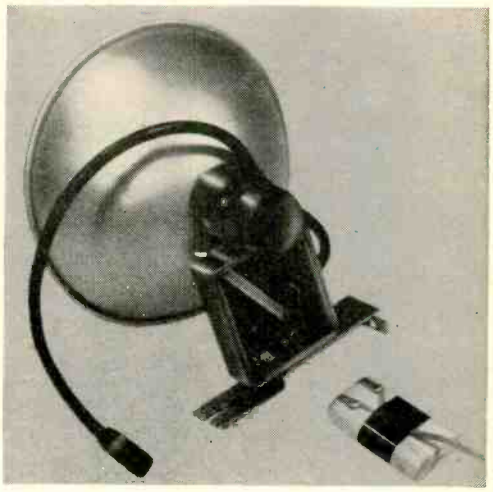
HAVE YOU ever missed a once-in-a-lifetime shot because of a flash-bulb misfire? If you have, it was probably a case of weak or discharged batteries. It's difficult to keep track of battery condition, especially if you don't use your camera equipment constantly. But it *is* possible to make sure that your flash gun always has plenty of available power—at least, wherever there's an a.c. outlet.

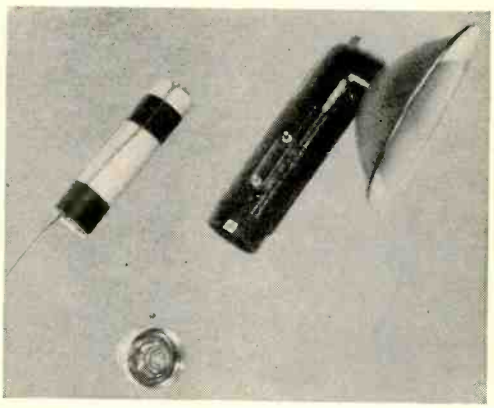
How? Just build this inexpensive "battery eliminator." Nothing but a simple, line-operated power supply, it delivers 3.5 volts of d.c. and has ample current capacity to fire off single or multiple flash bulbs every time. And not only can it be used with almost any flash gun employing two flashlight-type cells in series, but you can quickly disconnect it whenever standard battery operation is desired.

About the Circuit. Transformer *T1* steps down the line voltage from 117 to 6.3 volts a.c. Selenium stack *D1*, which contains two diodes having a common cathode, is connected as a full-wave rectifier—changing *T1*'s output from a.c. to d.c. No filter choke or resistor is used, but 250-μf. capacitor *C1* smooths out enough of the ripple in *D1*'s output to give reliable flash-bulb firing.

Power to the transformer is controlled by switch *S1*, which is wired in series with one of the primary leads. Pilot light *I1* serves two functions: it indicates when the power supply is ready for use and also "loads down" *C1*, preventing







It's not necessary to modify a flash gun to connect the battery eliminator cable. Kodak's "Duaflex" unit (above) has cable connected to spare plug-in battery clip. The Kodak "Brownie" gun (top, right) connects to cable via wooden adapter of the same size as the penlight cells, which are side by side; and so does the Argus gun (below, right) except that the "C" cells are end-to-end in this case.

the output voltage from rising to much higher than 3.5 volts.

Construction Tips. The unit is housed in a 4" x 2" x 2¾" aluminum utility box. Pilot lamp *I1* and switch *S1* are mounted on the box's front panel. Transformer *T1* and selenium rectifier stack *D1* are placed on opposite side walls. When you install the only remaining component, capacitor *C1*, across the terminals of *I1*, be sure to observe polarity.

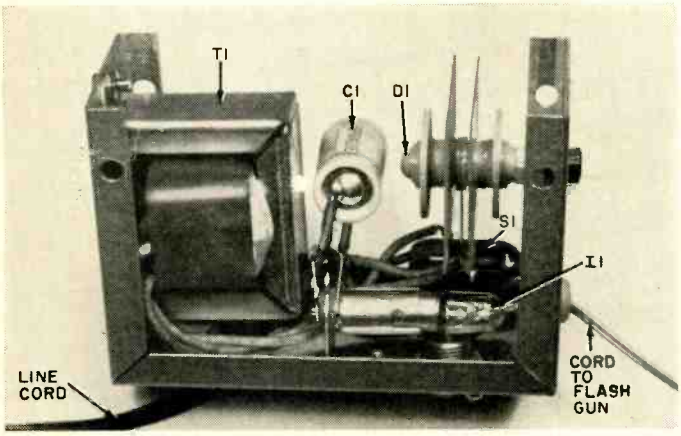
Bring the line cord into the box through a grommet-lined hole in the front panel. A similar hole, in the side of the box on which *D1* is mounted, accepts the flash-gun cord.

As shown on the schematic diagram, *D1*'s terminals are coded with yellow and red dots. Also illustrated is the color coding for *T1*'s leads. Leads or terminals of units not identical to those specified for *D1* and *T1* may be coded differently.

Making an Adapter. The most convenient way to wire the output of the power supply to your flash gun is by means of a wooden adapter. Shaped in the form of the batteries it is to replace and equipped with suitable contacts, the adapter can be slid right into the gun. And it will be just as easy to remove when you want to return to battery power.

A strategic notch or hole can be made in the flash-gun case to give clearance for the power supply cord. To minimize losses, this cord should be as short as possible—preferably no longer than 8 feet.

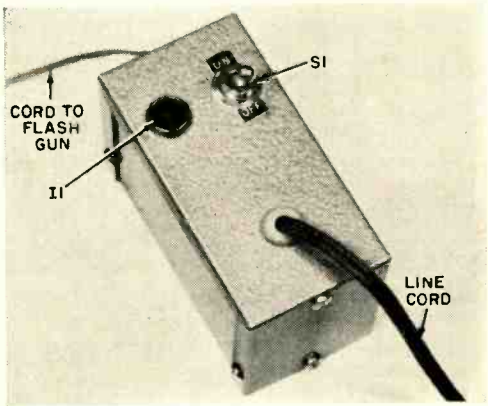
Illustrated here are wooden adapters for two "C" cells end-to-end and for two

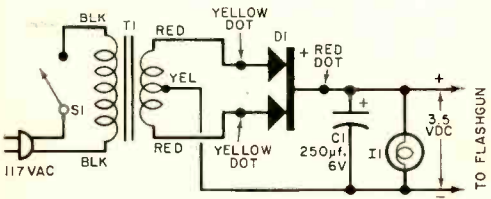


Small size of chassis box is important to a photographer who travels a lot. If you follow the parts placement shown at left, all parts will fit neatly in box. Indicator light I1 lets you know when the battery eliminator is ready to go.

PARTS LIST

C1—250-μf., 6-w.v.d.c., midget electrolytic capacitor (Sprague TVA-1102 or equivalent)
D1—Selenium rectifier stack (International Rectifier J14C1 or equivalent)
I1—6-8 volt, 0.15-amp pilot lamp (G.E. 47 or equivalent)
S1—S.p.s.t. switch
T1—Filament transformer; primary, 117 volts; secondary, 6.3 volts CT @ 1.2 amp (Stancor P6134 or equivalent)
1—4" x 2" x 2¾" aluminum utility box (Bud CU-2115-A or equivalent)
1—8' length of lightweight 2-conductor cable (Belden 8782 or equivalent)
Misc.—Line cord and plug, pilot lamp assembly, grommets, material for flash-gun adapters (if required—see text), wire, etc.





Schematic diagram of battery eliminator. Lamp I1 discharges capacitor as soon as S1 is set at "off."

penlight cells side-by-side. The former is cut from a dowel, the latter shaped from a block.

Contacts to substitute for those on penlight cells can be made by soldering small tabs (such as #6 solder lugs) to the undersides of thumbtacks. The tacks can then be pressed into the adapter and the wires soldered to the tabs.

You can make contacts to replace those on "C" or "D" cells from the snap-in "plug buttons" used to cover chassis holes. Bend out one spring "finger" on each button for use as a solder lug and straighten the others so that they can be tapped into the adapter.

If the battery holder in your flash gun is of the removable type, you may want to take the easy way out—just order a spare holder from your photo dealer and wire the power supply cord to it as pictured. If you prefer, of course, you can make an adapter as described above.

Operation. It's only necessary to plug the unit into any convenient wall outlet, slip the adapter into the flash gun, and close *S1*—then you're ready to shoot. For multi-flash shots, the extra flash guns are wired in parallel with the main one. Install an appropriate socket on the power supply cord so you can plug in the extra guns when needed.

The author has successfully used this photoflash power supply with single M-2, #5, #40 press, and SM flash bulbs, as well as with groups of up to four #5's. He hasn't had a misfire yet—and you won't either. -30-

Hi-Fi Lab Check

Fisher KX-200 Stereo Amplifier

Manufactured by Fisher Radio Corp., 21-21 44th Dr., Long Island City 1, N.Y.

Prices: $169.50 (kit); $24.95 (walnut or mahogany cabinet); $15.95 (metal cabinet).

WHAT are the most important things to look for in buying a hi-fi kit? Ease of assembly? Packaging? Appearance of finished product? Accuracy of the instruction manual? Performance specifications? Dollar value?

Take different proportions of all six ingredients, and you can have an amplifier that's a "dog" to build, but that will sound great. Another amplifier may go together like a dream, but be lacking in appearance and performance. And a third may simply cost too much money.

Does any amplifier kit offer a reasonable compromise of all six ingredients? Yes, several of them—and the Fisher KX-200 is one. It's easy to assemble (our test model went together in nine hours), has impressive specs and acknowledged good looks, plus attractive dollar value.

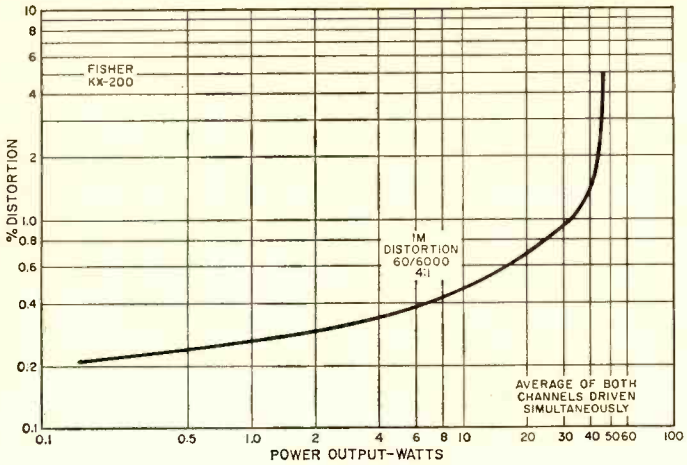
By the way, when you build this kit, you might be interested in comparing the photo on the cover of our December 1962 issue with Fig. 17-1 on page 40 of the Fisher KX-200 instruction manual.

CIRCUIT REPORT: The KX-200 is an integrated stereo amplifier rated by the manufacturer (according to IHFM standards) at 80 watts. The claimed r.m.s. power output is 35 watts per channel at 0.4% harmonic distortion and 0.8% IM distortion.

The amplifier uses only two tube types —three 12AX7's and two 7591's per channel. A solid-state power supply for the high voltage as well as preamplifier and driver stage heaters rounds off this straightforward circuit.

Two features of the KX-200 distinguish it from similar stereo amplifiers in its price category. One is the built-in

A meter is permanently mounted on the chassis of the Fisher KX-200 for use in accurately setting up the power output stages. Potentiometer controls for adjusting the bias and balance are mounted elsewhere on the chassis deck.



Intermodulation distortion of the KX-200 measured against the sine-wave power output in watts. Since many manufacturers don't rate IM with both channels in full operation, these figures may be slightly higher than those advertised.

meter and switching circuitry for balancing the power amplifier stages. The second is a third speaker (center channel) output, effectively combining the right and left channels. The output level of this center channel is controlled from the front panel.

HIRSCH-HOUCK LAB CHECK: Fisher's KX-200 is another of the "new breed" of stereo amplifiers that have a remarkably flat frequency and power response. Harmonic and IM distortion measurements either equalled or bettered the manufacturer's claims. This is strong evidence that the KX-200 can drive almost any speaker system without annoying distortion or overload.

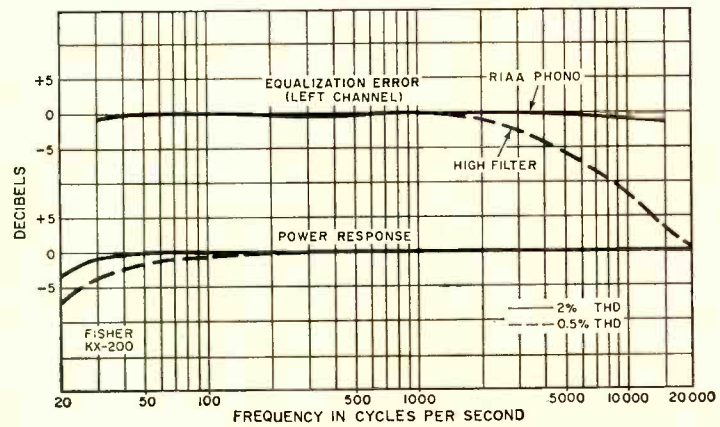
Sensitivity of the KX-200 was 0.002 volt on phono and 0.18 volt on tuner input for 10 watts of sine-wave output. There is no crosstalk between magnetic phono input and either tuner and auxiliary inputs.

Tone control range is within ± 1.5 db of the manufacturer's 30 db claim (30- and 15,000-cycle measurement). The loudness contour curve is well shaped, giving a boost of 15 db at 30 cycles, 0.5 db at 1000 cycles, and 4.5 db at 15,000 cycles.

Total hum and noise pickup is down more than 60 db on all input circuits.

IN CLOSING: The tasteful design of factory-wired Fisher hi-fi equipment has been carried over to the company's kit line. There is nothing, externally or internally, to distinguish this stereo amplifier from an off-the-shelf item costing $90-$100 more.

Assembly of the KX-200 is a pleasant and satisfying task, easily accomplished in about four evenings.

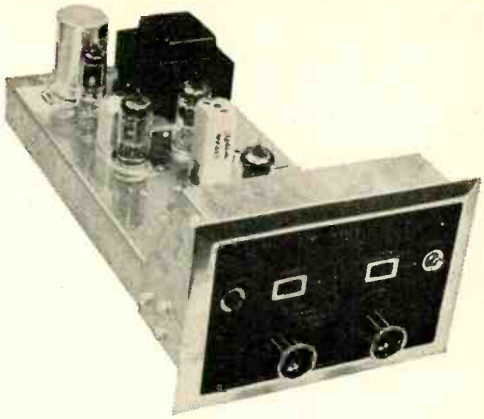


Power response and phono equalization for the left channel; the 0 db level used here is equivalent to 32 watts sine-wave output. Accuracy of the RIAA curve speaks for itself; the dashed line in this instance shows effect of switching "High Filter" into preamplifier circuit.

Scott LM-35 Multiplex Adapter

Manufactured by H. H. Scott, Inc., 111 Powder Mill Rd., Maynard, Mass.

Prices: $79.95 (kit); $9.95 (metal cabinet with leatherette finish); optional Stereo Signal Light, $17.95 (available assembled only).



WITHOUT getting involved in an argument over historical priorities, the factory-wired, fully-assembled version (Model 335) of the new LM-35 multiplex kit was probably the first good-quality multiplex adapter on the market. It is now being marketed as a kit to permit confirmed kit-builders who have invested in the LT-10 or similar-quality mono FM tuners to receive FM-stereo.

Assembly of the LM-35 is a "snap." The most fumble-thumbed builder could probably do the job in under 3 hours.

Scott has also made available for $17.95 a stereo signal light, known as the Model 55 "Stereo Guide." This is a little pre-assembled circuit that sits on the chassis of the LM-35 and, by lighting one of the front panel neon lamps on the LM-35, tells whether or not an FM station is broadcasting stereo. We strongly recommend this "extra" if only for its overwhelming psychological value.

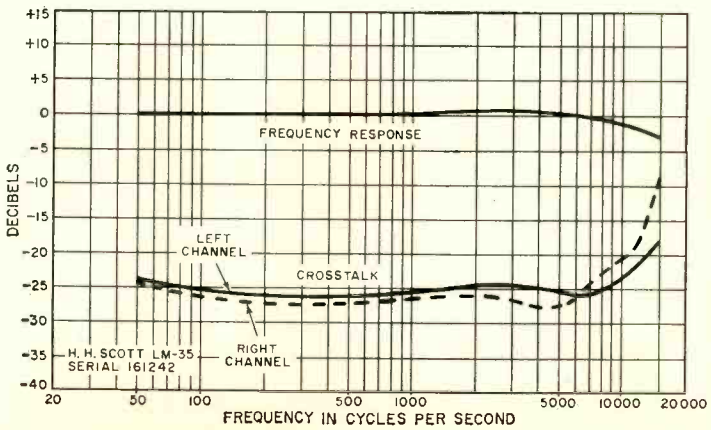
CIRCUIT REPORT: The LM-35 is self-powered and draws sufficiently low wattage to be permanently connected to the on/off switch of most stereo amplifiers. The four-tube multiplex subchassis contains the familiar Scott time-division demodulating circuit. It comes pre-assembled and pre-aligned. Plate voltages for the adapter are provided by a simple rectifier using a 6X4.

The Model 55 "Stereo Guide" (optional extra) also has a very low power drain. It uses a separate 6AV6 to detect and amplify the 19-kc. pilot carrier. Indication of stereo broadcasts is provided by a neon lamp on the front panel of the adapter.

HIRSCH-HOUCK LAB CHECK: As expected, the audio frequency response of the LM-35 is nominally flat from 10,000 cycles down to below 50 cycles. At 15,000 cycles, the adapter has rolled off only about 3 db. This is somewhat better than most multiplex adapters in this price category.

Separation is relatively flat from 50 to 7500 cycles. In this slice of the audio spectrum, the LM-35 averages 26 db separation, or crosstalk between channels. At 12,000 cycles, the average crosstalk is 20 db. This is also somewhat better than most adapters—*regardless of price.*

(*Continued on page* 109)



Frequency response of the Scott LM-35 is within ±1.5 db from 50 through 15,000 cycles; crosstalk or separation shows little variation from 50 through 10,000 cycles. These curves do not reflect loss of separation or frequency response when special noise-reducing filters (controlled from the front panel of the LM-35) are switched into the circuit.

Equipment Report

Olson CB Surprise Package

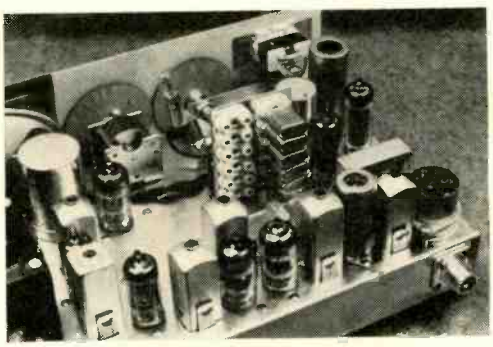
CITIZENS BAND TRANSCEIVERS have probably undergone the most rapid "evolution" in the history of electronics. In 1959, inflexible 1- and 2-channel models populated the market. Today, only four short years later, the average CB transceiver is smaller, lighter, more stable, more flexible—and cheaper(!).

A superb example of today's CB transceivers is the RA-530 "Spotter" by Olson Electronics (260 S. Forge St., Akron 8, Ohio). Priced at $119.95 (plus postage), the RA-530 has provisions for 11-channel transmit with internally switched crystals, plus a panel-mounted crystal holder for a grand total of 12 possible transmit channels. Instead of receive crystals, there's a special "Audio-Visual" "spotter" for putting the all-channel tunable receiver on the proper frequency. Tune the receiver to the transmit crystal frequency, and two things happen: a distinctive tone signal is heard, and a reading is registered on the built-in S-meter.

The RA-530 tested by the P.E. staff had clean, crisp modulation, and delivered 3.3 watts from a link-coupled tank circuit. —30—

Socket for the 12th crystal is mounted on front panel under S-meter. Slide switch in lower right-hand corner of panel activates the "Audio-Visual" receive channel spotter.

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



Olson's "Spotter" has a double-conversion receiver circuit, insuring excellent stability and selectivity. A half-filled crystal bank is visible in the center of the chassis.

ADVANCED EXPERIMENTERS CORNER

Variable Voltage . . . You Pick It

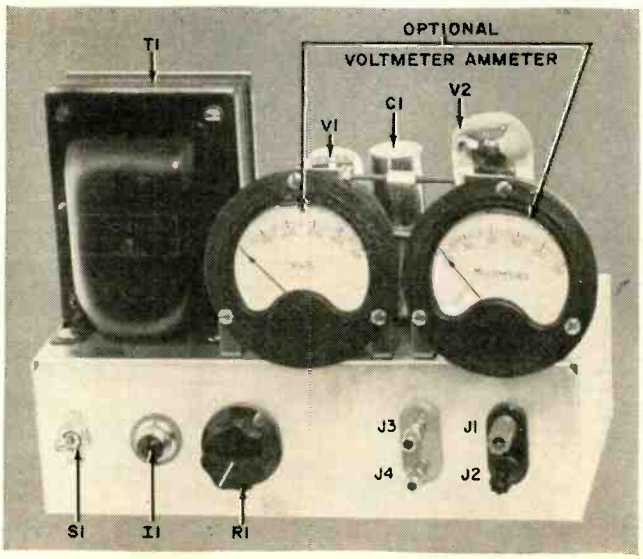
By PAUL S. LEDERER

DO much experimenting? Then you'll agree that a power supply which is adjustable over a fairly wide voltage range can come in mighty handy. You probably have most (if not all) of the parts needed for it in your workshop, since there's nothing very critical about such a circuit.

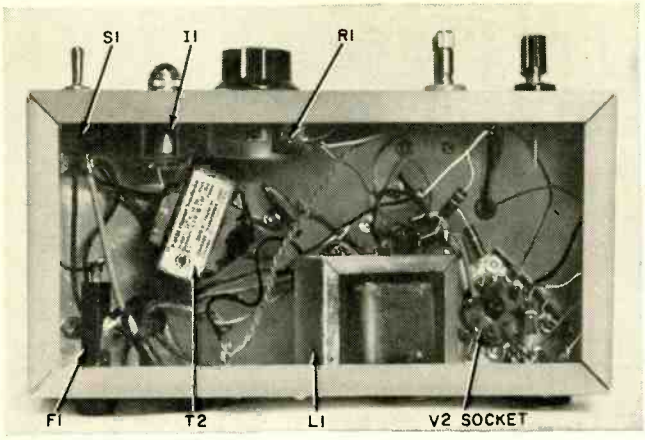
Voltages varying from about 60 to 300 volts, depending upon the load across jacks *J1* and *J2*, as well as the setting of potentiometer *R1*, are possible with this unit. The current capability of the supply is a function of the output voltage and is also governed by the current rating of transformer *T1*, and the plate dissipation rating of the tube used for *V2*. The output at jacks *J3* and *J4* is 6.3 volts a.c. center-tapped to ground, which puts a filament voltage as well as B+ at your disposal.

As shown in the schematic, the supply consists of a full-wave rectifier—with a choke input filter—followed by a triode-connected tetrode in series with the filtered output. A 5U4-GB is suggested for rectifier tube *V1*, but a 5Y3-GT or other similar rectifier tube can be employed. And although the author used a 6L6 for voltage control tube *V2*, you can substitute one of the other tetrodes —a 5881, a KT66, etc.—if you wish, for greater current handling capability. A 6L6 (with the exception of a 6L6-GC) has a plate dissipation of 19 watts and so will handle considerably less current than a KT66, which has a maximum plate dissipation rating of 32 watts.

The output of the supply is adjusted by varying the grid bias of *V2* (controlled by *R1*). Since this varies *V2*'s internal resistance, the voltage appearing at *V2*'s cathode (which is connected to *J1*) can be made to increase or de-



Parts layout is not critical and is determined mostly by the size and function of each part. The tubes, power transformer, and capacitors are mounted on top of the chassis; controls, indicator light, and output jacks on the front lip. Meters are optional.



After all the parts are mounted, with T2 and L1 on the underside of the chassis, wire the power supply using point-to-point technique.

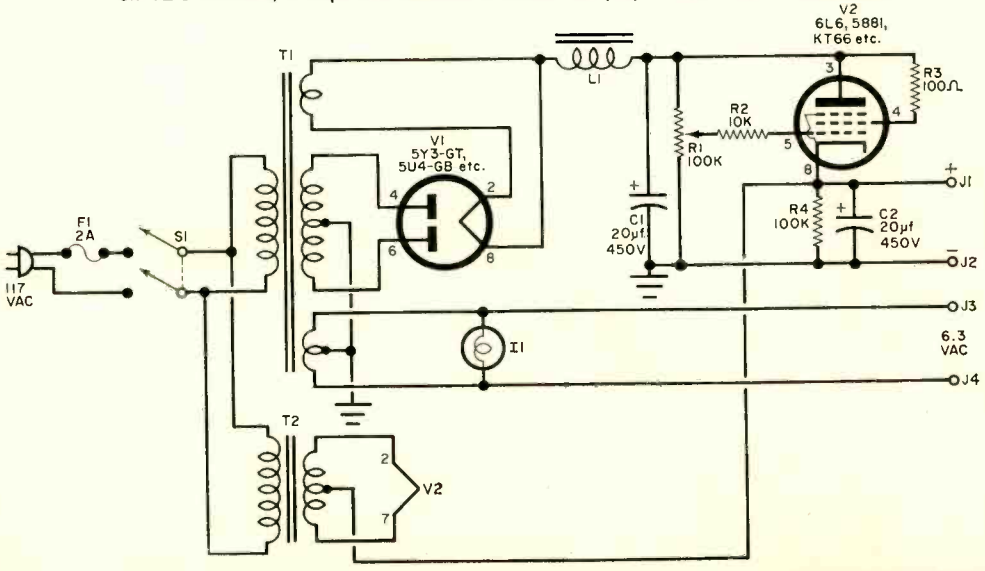
PARTS LIST

C1, C2—20-μf., 450-w.v.d.c. electrolytic capacitor
F1—2-amp, 3AG fuse
I1—#47 pilot lamp
J1/ J2, J3/J4—Dual binding posts (H. H. Smith 269RB or equivalent)
L1—Filter choke; 7-henry, 150-ma., 200 ohms (Stancor C1710 or equivalent)
R1—100,000-ohm potentiometer, linear taper
R2—10,000-ohm, ½-watt resistor
R3—100-ohm, 1-watt resistor
R4—100,000-ohm, 1-watt resistor
S1—D.p.s.t. switch
T1—Power transformer; primary, 117 volts a.c.; secondaries, 750 volts CT @ 150 ma., 6.3 volts CT @ 4.5 amp, 5.0 volts @ 3 amp (Stancor PC-8411)
T2—Filament transformer; primary, 117 volts a.c.; secondary, 6.3 volts CT @ 1.2 amp (Stancor P 6134 or equivalent)
V1—5U4-GB tube (or 5Y3-GT, etc.—see text)
V2—6L6 tube (or 5881, KT66, etc.—see text)
1—3" x 5" x 10" aluminum chassis (Bud AC-404 or equivalent)
Misc.—Mounting assemblies for F1 and I1, tube sockets for V1 and V2, knob for R1, etc.

crease accordingly. Resistors *R2* and *R3* prevent parasitic oscillations.

Modifications can be made quite easily, for adaptation of the circuit to components you wish to use. If you have a 12-volt filament transformer around and the current rating of the supply does not have to be very high, you can use a 12L6 for *V2*. Also, an s.p.s.t. switch can be substituted for *S1*. —30—

Schematic diagram of variable-voltage power supply. Because of high d.c. potential on V2's cathode, a separate filament transformer (T2) is required for this tube.



TRANSISTOR TESTER ROUNDUP

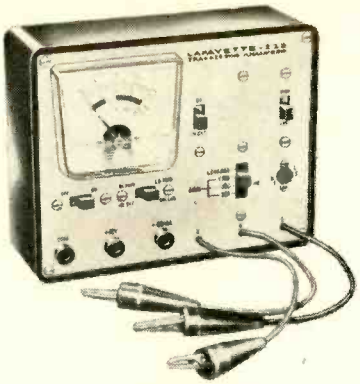
EXPERIMENTERS, technicians and hobbyists who are familiar with the ease of operation and reliability of tube testers sometimes find themselves frustrated when they try to check transistors. Often, a transistor may check "Good" when tested, yet fail to work in a circuit. In other cases, a transistor which tests "Bad" may give acceptable results in some circuits.

To understand these discrepancies, we must consider the basic problem of what constitutes a "Good" or "Bad" transistor, and it might help if we compare the transistor to the vacuum tube. Both tubes and transistors can become defective in the same general ways. Both can develop "opens," "shorts," or a change in their electrical characteristics. Of these three defects, "opens" and "shorts" are relatively easy to determine in both devices, but the last type—a change in characteristics—is a real puzzler as far as transistor tests are concerned.

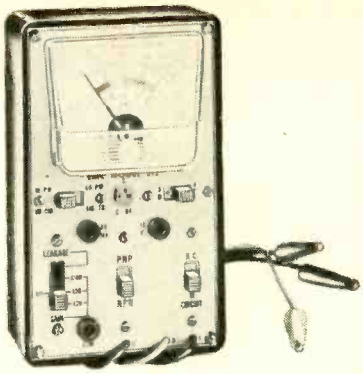
High Z and Low Z. Except in high-frequency applications, a vacuum tube's input (control grid) and output (plate) circuits are virtually isolated. In addition, since the tube is a high-impedance device, its characteristics are often independent of circuit values. For example, changing a grid resistor from 100,000 to 500,000 ohms may cause little

By E. G. LOUIS

Knight-Kit 83 Y 149-J



Lafayette KT-223



EMC 212

or no apparent change in the performance of an audio amplifier. Similarly, a change in the value of a plate resistor from, say, 100,000 to 250,000 ohms may not affect circuit operation. Finally, a temporary overload will seldom, if ever, change a vacuum tube's characteristics.

In essence, then, the vacuum tube is a pretty independent device. If we determine the value of one or two critical characteristics, we can be pretty sure the tube is "Good" or "Bad." This critical value may be the tube's *emission* where a simple check is needed or its *mutual conductance* where more exacting tests are desired.

The transistor, in contrast, is a low-impedance device which becomes an integral part of the circuit in which it is used. As shown by the equivalent circuit given in Fig. 1, there is a direct resistive connection between every electrode, shunted by interelectrode capacities and by diode elements. The unit's input (base) and output (collector) circuits are not isolated and a change in either will directly affect the other. A relatively small change in an external base or collector load resistor may cause an appreciable change in circuit operation, as will a moderate change in the transistor's internal impedances (resist-

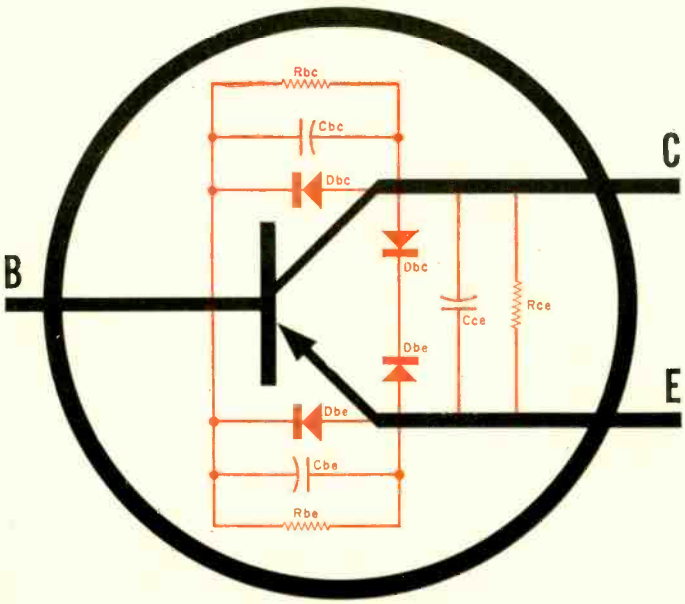
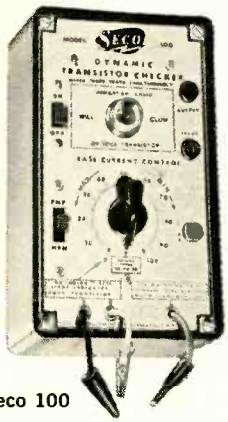


Fig. 1. Symbol shown in black is used to indicate a pnp transistor in schematic diagrams. The symbols shown in color are equivalent circuit elements the transistor exhibits at its terminals under normal operating conditions.

Sencore TR115



Seco 100

GC Electronics 36-560

ances) or its electrical characteristics.

In addition, the transistor's electrical characteristics may change if the unit is subjected to overload conditions. The device may still be a "Good" transistor in that it has the basic properties of a transistor, but may require entirely different circuit values for proper operation. Thus, two transistors with the same type number may check "Good," yet one will work in a given circuit and the other will not. Of course, chances are the second transistor will give satisfactory performance *if* biases and circuit load values are changed to match its characteristics, but it is not practical to change circuit values every time a transistor is changed.

Finally, even with "Good" transistors, it is often difficult to make direct comparisons as to quality, for transistors are manufactured to much broader tolerances than most other electronic components. It is common practice for manufacturers to specify *minimum* or *maximum* values for characteristics like *beta,* cutoff frequency, I_{CO}, and base resistance rather than exact values. A *beta* "spread" of three or five to one is not unusual for a given type. Thus, a 2N78 transistor which has a *beta* of from 45 to 135 may be considered "Good" by the manufacturer. If this type of transistor is used in a circuit requiring a *beta* of from 60 to 90 for proper operation, many units will give satisfactory performance but those units with *beta* values near their outer tolerance limits will not work—even though they are "Good."

Many more transistor characteristics exist, *any* of which may be important as far as a particular circuit is concerned. Some of these characteristics are maximum voltage and current ratings, input and output impedances, interelectrode capacitances, temperature characteristics, and internal resistances. This means, of course, that we can no longer be concerned with just one or two "critical" characteristics to evaluate a transistor properly. *All of the unit's characteristics* are important, although their relative importance may vary considerably from one circuit to another. For example, in an amplifier circuit with a high degree of negative feedback, the *beta* (gain) of the transistor may be comparatively unimportant within broad limits.

There are two methods of checking a transistor *accurately*. One is to determine which of the transistor's characteristics are critical as far as the circuit in question is concerned, and then to check these values. The alternative method is to check all its characteristics against the semiconductor manufacturer's detailed specifications. In either case, considerable test equipment is required.

Obviously, neither of these methods is satisfactory for quick "Good" or "Bad" checks in the experimenter's laboratory or service technician's workshop. A compromise between accuracy and ease of testing is necessary.

Basic Transistor Test. One of the simplest tests you can make is to determine if the device *is* a transistor. This test

will tell you whether the part is "open" or "shorted."

Referring back to the transistor's equivalent circuit (Fig. 1), we see that the base-emitter and base-collector junctions form semiconductor diodes. In one sense, the transistor consists, in part, of two diodes connected "back-to-back." These diode junctions can be checked quite easily with a standard series-type ohmmeter. The technique is relatively simple.

First, you measure the d.c. resistance between the base and emitter leads, as shown in Fig. 2. Note the value and reverse the ohmmeter leads, making a second measurement. If the base-emitter junction is in good condition, one measurement will indicate the diode's *forward* (conducting) resistance, the other its *reverse* (non-conducting) resistance. The *ratio* between the two measurements, rather than their exact values, is the important factor. For a good diode junction, this ratio must not be less than 20 to 1 and may run to 100 to 1 or higher. Typically, if one measurement is,

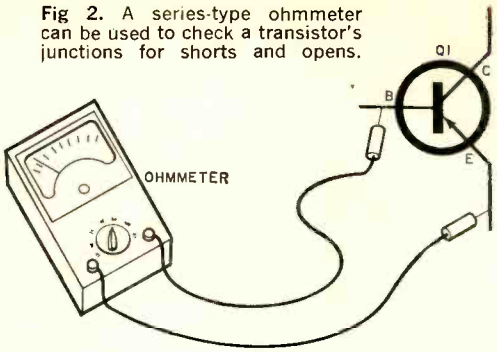


Fig 2. A series-type ohmmeter can be used to check a transistor's junctions for shorts and opens.

say, 1000 ohms, the reverse measurement should be 20,000 to 100,000 ohms, or more.

This procedure is then repeated, but with a check made between the base and collector leads to test the base-collector junction. Again, two measurements are made and their ratio compared.

In either case, if both forward and reverse resistance measurements are low, the junction is *shorted*. If both measurements are very high, the junction is partially *open* (an "infinite" measurement

Table 1. Definitions of common transistor characteristics used when referring to transistor quality.

TERM	DEFINITION
h_{fb} (alpha)	forward current transfer ratio in common-base circuit with output a.c. short-circuited (GAIN)
h_{fe} (beta)	forward current transfer ratio in common-emitter circuit with output a.c. short-circuited (GAIN)
h_{FE}	d.c. forward current transfer ratio in common-emitter circuit with output d.c. short-circuited ($h_{FE}=I_C/I_B$)[1] (D.C. GAIN)
I_{CBO} (I_{CO})	d.c. collector current when collector junction is reverse-biased and emitter is open-circuited, under specified test conditions
I_{CEO}	d.c. collector current with collector junction reverse-biased and base open-circuited
Leakage	generally, collector current with fixed voltage applied between emitter and collector, base open; approximately equal to I_{CBO} multiplied by beta[1]
I_B	d.c. base current
I_C	d.c. collector current
I_E	d.c. emitter current
I_F	d.c. forward current; the current when a diode junction is biased in its forward or "conducting" direction[1]
I_R	d.c. reverse current; the current when a diode junction is biased in its reverse or "non-conducting" direction[1]
f_{hfe}	beta cutoff frequency; the point at which a transistor's gain in the common emitter configuration is 0.707 of its low frequency value[2]
f_{max}	maximum frequency of oscillation; the point at which a transistor has "unity" gain; much higher than beta cutoff frequency in most cases, and sometimes called "Figure of Merit"[2]

1. Most low- to medium-priced transistor checkers test these transistor characteristics.

2. These figures, although important in determining a transistor's operation in i.f., r.f., and converter service, cannot be measured on service-type transistor checkers.

EICO 680

Triplett 690-A

Simpson 650

Superior 88

is made with an open junction). If both readings are identical, the junction is no longer acting as a diode and the device will not operate as a transistor.

However, the ohmmeter test described above—while quick, easy, and quite reliable as far as completely defective transistors are concerned—is of limited value in determining a transistor's electrical characteristics. Here, more precise tests are necessary.

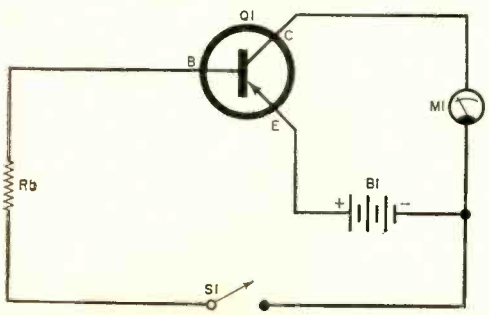
There are basically two general types of transistor tests that can be performed: *static* and *dynamic*. With static tests, we check the transistor's d.c. characteristics. With dynamic tests, we check the unit's performance under typical operating conditions, that is, with specified biases and an a.c. signal applied. Some of the transistor's characteristics which may be checked with static and dynamic tests are listed in Table 1. Let's examine the two basic techniques.

Static Tests. In a theoretically "ideal" transistor, there should be *zero* current flow if a d.c. voltage is applied between the unit's emitter and collector electrodes, the base remaining open. Any "leakage" current that may flow indicates that the transistor is less than "perfect." The greater this current, the poorer the transistor.

To check leakage, then, we simply apply a d.c. voltage between the transistor's emitter and collector, placing a meter in series to determine the resulting current, as illustrated in Fig. 3. In a "good" small-signal transistor, the current will seldom exceed a few microamperes, ranging, perhaps, to 200 microamperes in the case of low-cost, poor-quality transistors. In power transistors, a normal leakage current is somewhat higher, and may approach a milliampere. The leakage current measured in this fashion approximates the transistor's I_{CBO} multiplied by its *beta* (see Table 1).

If we apply a small base bias current while set up for a leakage test, there should be a corresponding increase in collector current. The resulting collector current will equal the base bias multiplied by the transistor's gain (*beta*) plus its inherent "leakage." With a fixed bias applied, then, the collector current

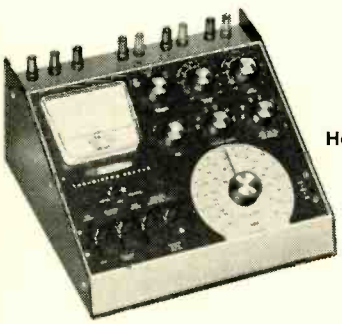
Fig. 3. Circuit of a simple transistor tester. With S1 open, meter reads leakage current; and with S1 closed, meter indicates d.c. gain (h_{FE}).



MANUFACTURER	MODEL	D.C. TESTS				DYNAMIC TESTS	IN-CIRCUIT TESTS	PRICE[1]
		Opens	Shorts	Leakage	Gain			
Heath	IT-10	✓	✓	✓	✓			$ 6.95 (K)
Knight-Kit	83Y149-J	✓	✓	✓	✓			8.95 (K)
Lafayette	KT-223	✓	✓	✓	✓	✓	✓	12.75 (K)
EMC	212	✓	✓	✓	✓	✓	✓	13.50 (K) 18.50 (W)
Paralan						✓	✓	15.95
Sencore	TR115	✓	✓	✓	✓			15.95 (K) 24.45 (W)
Seco	100	✓	✓		✓	✓	✓	19.95
GC Electronics	36-560	✓	✓	✓	✓		✓	19.95
EICO	680	✓	✓	✓	✓			25.95 (K) 39.95 (W)
Simpson	650[2]	✓	✓	✓	✓			26.95
Triplett	690-A	✓	✓	✓	✓			32.50
Superior	88					✓		38.50
GC Electronics	35-568	✓	✓	✓	✓			49.50
Triplett	2590	✓	✓	✓	✓			54.50
Heath	IM-30	✓	✓	✓	✓			54.88 (K)
Sencore	TR110					✓	✓	58.31
Seco	250B	✓	✓	✓	✓	✓	✓	74.50
B & K	960	✓	✓	✓	✓		✓	99.95
Precision	960	✓	✓	✓	✓			107.75
Hickok	890					✓	✓	137.50

1. When an instrument is offered in both kit (K) and factory-wired (W) form, both prices are given.
2. Add-on attachment to Simpson Type 260 VOM.

Table 2. Service-type transistor testers currently on the market; expensive laboratory units and combination tube/transistor checkers have been omitted. For descriptions of these testers, consult a radio supply house catalog or write to the manufacturer.



Heath IM-30

Precision 960

is directly proportional to the transistor's d.c. gain or "d.c. *beta*."

The simplest method of applying a base bias for a gain test is to connect a bias resistor from the base back to the d.c. source (battery), as indicated in the diagram (Fig. 3). Thus, the complete setup shown is suitable for static tests of *leakage* and *gain*. The leakage test is made first, then *S1* is closed for a gain test. Except for a battery polarity reversing switch to permit checks of both *pnp* and *npn* transistors, this circuit is basically the one used in the majority of low-cost commercial transistor testers.

A *d.c. beta* test, as outlined above, is roughly analogous to an *emission* test when referring to vacuum tubes.

Dynamic Tests. For a more precise measurement of a transistor's *beta,* the test should be made under typical operating conditions, that is, with the transistor used as an amplifier, with specified d.c. biases applied, and with a known a.c. signal used for test purposes. One arrangement for such a dynamic test is

(*Continued on page* 108)

AUDIO DESIGN NOTE

1/2 transistor replaces thermistor

By JAMES E. PUGH, Jr.

THE HIGH EFFICIENCY of the Class B power amplifier makes it very popular for transistor circuits. However, it does have some disadvantages: operating characteristics vary with temperature, as with any transistorized device. In addition, distortion increases rapidly as battery voltage decreases.

A partial compensation is worked into many designs through a resistor/thermistor combination. This takes care of the effects of temperature variations, but it still permits severe distortion when battery voltage drops. The circuit shown here offers everything that a circuit with a resistor/thermistor combo does—and it also takes care of the distortion due to low battery voltages.

As you can see from the schematic diagram, the "trick" involves nothing more than the substitution of an inexpensive germanium diode (*D1*) for the resistor/thermistor combination. A special low-cost germanium diode (such as RCA's 1N2326) is available for use with low-power transistors such as the 2N586 shown here. But an even more inexpensive germanium "diode" can probably be found in your spare parts box: a defunct power transistor having either the base-to-emitter or the base-to-collector "diode" still in good condition.

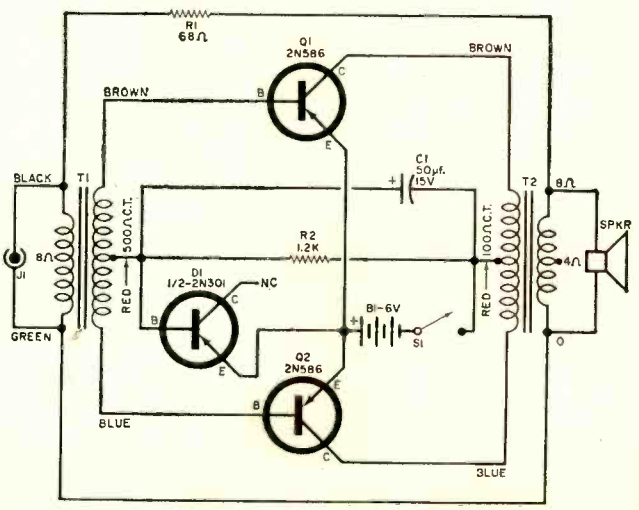
In this circuit, the "diode" (half a transistor) will compensate for temperature variations in much the same way that a thermistor does. Even more important, it will also hold the base-to-emitter bias constant over approximately a ±40% change in battery voltage. (Of course, the maximum power output will drop as the battery voltage drops, but this isn't too serious.)

The circuit below is only one possible type of hookup. As it happens, the base-to-emitter section of a transistor was used here, but the base-to-collector portion would be hooked up in the same way and would work equally well. —30—

PARTS LIST

B1—6-volt battery (four size C or D cells in series)
C1—50-μf., 15-w.v.d.c. miniature electrolytic capacitor
D1—½ 2N301 transistor—see text
J1—RCA phono jack
Q1, Q2—2N586 transistor (or equivalent)
R1—68-ohm, ½-watt resistor
R2—1200-ohm, ½-watt resistor
S1—S.p.s.t. toggle switch
T1—Transistor input transformer: primary, 8 ohms; secondary, 500 ohms CT (Argonne AR-164 or equivalent)
T2—Transistor output transformer: primary, 100 ohms CT; secondaries, 4 and 8 ohms (Triad TY-30X or equivalent)
SPKR—PM speaker, 4- or 8-ohm voice coil
Misc.—Transistor sockets, dry cell holders, hookup wire, hardware, etc.

Diagram and parts list for transistorized audio amplifier using a Class B output stage and temperature/bias compensation with "half" of a transistor.



Mono or Stereo Headset. It's in the way you hook it up. Oversized cushions add to listening comfort.

SURPLUS EARPIECE

A "gold mine" of uses for an inexpensive telephone earpiece

AMONG the best buys on the surplus market today are low-impedance, dynamic earpieces. The most common types you're apt to find on your dealer's shelves are the Permoflux PDR-1 (12 ohms) and the Telephonics TDH-38 (10 ohms).* Each model contains a 2"-diameter PM speaker having a plasticized cone, and will handle plenty of volume without distortion.

Costing only pennies, the good-quality earpieces can be used in a great variety of ways. You'll find some suggestions below, and your own imagination should provide many more. So why not invest in half a dozen units or so and go to work? You'll be glad you did.

Mono or Stereo Headset. The first thing that comes to mind, of course, is to assemble a low-impedance headset. Besides two earpieces, all you'll need is a suitable headband, a set of ear cushions, and a suitable cord. Headbands and cushions are standard surplus items. A commercial cord set can be purchased, or ordinary zip cord can be used.

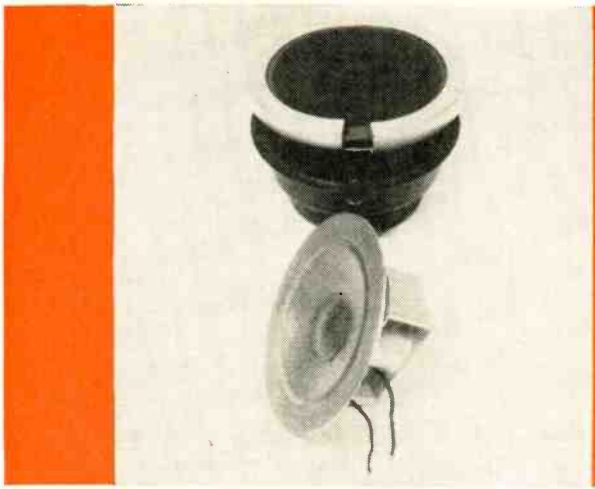
Wire the earpieces in series to get an impedance of about 20 ohms, in parallel for a 5-ohm impedance (approximately). If you'd like to do some stereo listening, the earpieces should be wired independently (though you can use one "common" lead to make the cord set less bulky).

Miniature Speaker. The 2" miniature speaker inside the earpiece case is fine for experimental receivers—or for replacement use in many commercial transistor sets. For applications where space is not limited, the earpiece can be used intact. If space is at a premium, however, you'll have to remove the speaker.

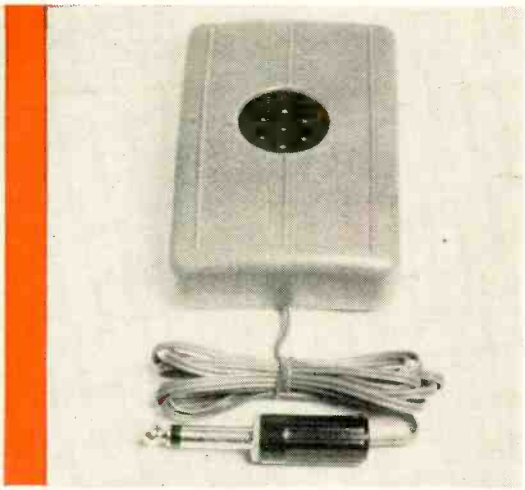
To dismantle the earpiece, carefully saw a slot across its metal retaining ring (with the Permoflux units, you'll also have to drill six rivets out of the ring). Now remove the ring, and the speaker can be lifted out and disconnected.

Under-the-Pillow Speaker. To make an under-the-pillow speaker for late evening listening or for hospital use, an

**If you have trouble locating earpieces, try Greylock Electronics, 438 Central Ave., Albany 6, N.Y. They'll supply one of the models mentioned (or the equivalent) for 49 cents each, postpaid.*



Miniature Speaker. All you have to do is undo what the maker did, and presto—a replacement speaker!



Pillow Speaker. Music to dream by can be had for the price of a soap box, wire, plug, and earpiece.

BONANZA

By ART TRAUFFER

earpiece can be mounted in a plastic soap box. Cut a 1"-diameter hole in the top of the box, then cement the earpiece under the hole. Attach a length of lightweight zip cord to the earpiece, run it out of the box through a hole, and terminate it in a phone plug.

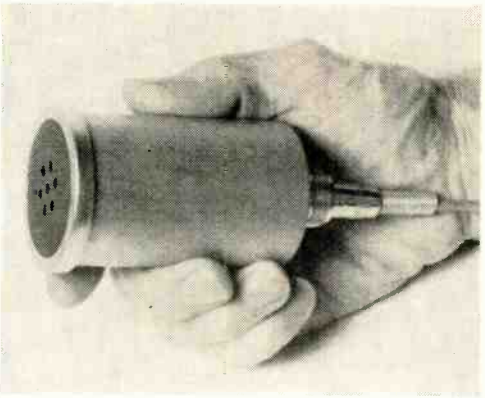
You'll want to install a closed-circuit phone jack in the receiver. Wire it so that the main speaker's voice coil is disconnected when the under-the-pillow unit is plugged in.

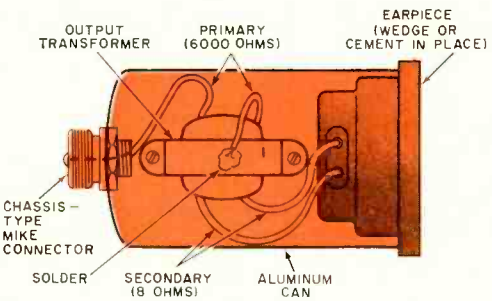
If the receiver is an a.c./d.c. model having one side of its voice-coil circuit grounded, a danger of shock exists. It's best to isolate this circuit by disconnecting the grounds at the output transformer secondary and speaker voice coil. Run an insulated wire between these points instead.

Dynamic Microphone. Use one of your earpieces with an inexpensive output transformer (6000-ohm primary, 8-ohm secondary), and you'll have a high-impedance, dynamic mike. For proper shielding, the earpiece and transformer should be housed in a metal enclosure (the author used an aluminum salt shaker—see diagram and photo). A standard mike connector (Amphenol 75-PC1M or equivalent) completes the unit.

Be sure the connector is well grounded

(*Continued on page* 111)





Dynamic Microphone. Inexpensive as the "tin" can that houses it, this low-cost mike is ideally suited for voice recordings and p.a. announcements.

Give Your Radio Instant Sound

By JAMES A. FRED

NOW THAT transistor radios—and "instant sound"—are here, it's a bit irritating to have to wait 15 seconds or longer for the kitchen radio to warm up. But it would be a waste to discard that tube job for a transistor set, especially since a semiconductor diode can give your a.c./d.c. vacuum-tube radio *instant sound*. How? It's simple.

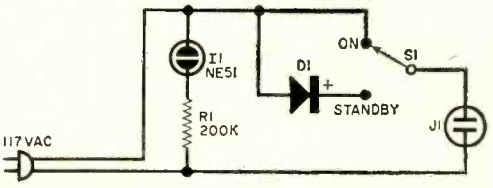
If you insert a diode (*D1*) in series with the receiver's line cord and leave the receiver turned on, approximately half the line voltage will be available for the heaters of the tubes in the receiver. And this is exactly what is done in the "Instant Sound Control Box." When *S1* is in the *STANDBY* mode, the tube heaters are partially "warmed." Therefore, flipping switch *S1* to *ON* brings them to full efficiency very quickly.

The parts are few, and easy to hook up. Diode *D1* is rated at 2 amperes at 200 PIV minimum, resistor *R1* at ½ watt. Switch *S1* can be any s.p.d.t. toggle switch rated at 125 volts a.c. or more.

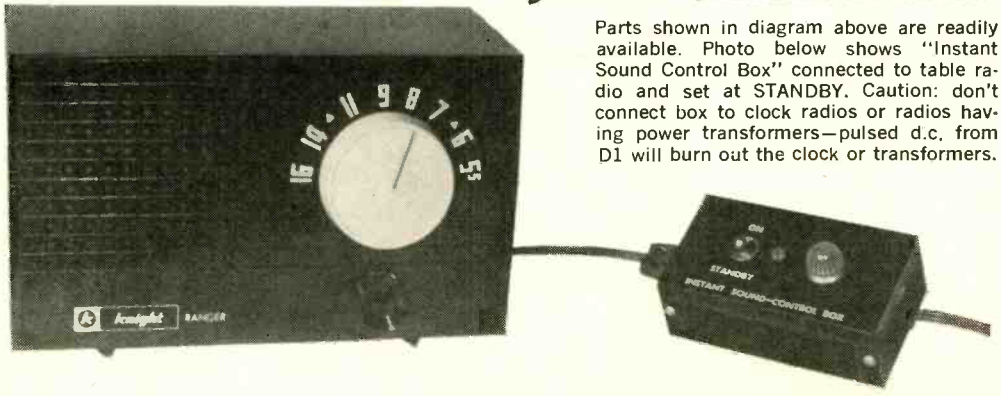
Assemble the parts in a 4" x 2⅛" x 1⅝" aluminum chassis box (Bud CU-2102A), and wire them as shown, carefully avoiding shorts to the box. Plug the box's line cord into a 117-volt outlet, and plug the receiver into jack *J1*.

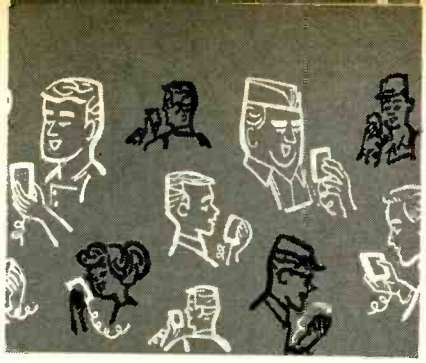
If sound at a low volume is heard from the receiver with *S1* in the *STANDBY* position, reverse the plug from the radio in jack *J1*. Now *D1* in the "control box" and the diode or rectifier tube in the receiver are "bucking," and no plate voltage can be rectified. But flip *S1* to *ON*, and whamo—instant sound.

Although neon bulb *I1* isn't really necessary, it does provide a visual reminder that the radio is "warmed up," and ready whenever you need it. —30—



Parts shown in diagram above are readily available. Photo below shows "Instant Sound Control Box" connected to table radio and set at STANDBY. Caution: don't connect box to clock radios or radios having power transformers—pulsed d.c. from D1 will burn out the clock or transformers.





On the Citizens Band

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

MUCH water flowed over the CB dam last year—most of it good, some of it bad. Fortunately, the "good" promises a gigantic increase, whereas the "bad" seems to have created a legal means by which it will—in time—eliminate itself.

Whether it was used to aid in parade traffic, assist search parties, track down criminals, or rush home after a mobile 10-33 call announced Junior's tumble down the basement stairs, the Citizens Band has cut a definite notch in the communications spectrum. It has solved a voluminous number of problems for the business man, including bringing his operating costs down with less mileage and vehicle wear-and-tear.

The harassed farmer, the stranded motorist, the accident victim, or the wife with the reheated supper—all realize the value of the band, and its potentialities. This is to say nothing of the thousands of CB'ers who have organized or joined with rescue groups, Civil Defense organizations, sheriff's patrols, and other civic or governmental associations. It sort of makes a person wonder how long it'll be before new autos will automatically come equipped with CB transceivers, much as they are with broadcast receivers today.

Need a License? If you're in the process of applying for a CB license, new or renewal, keep in mind that when Father Time walks out the door on December 31st, he takes FCC Form 505, SEPTEMBER 1958, with him! This form cannot be used in 1963 for any of the Citizens Radio Service Classes (A, B, C, D). The old form has been replaced by FCC Form 505, APRIL 1962, and covers Classes B, C, and D. Applicants for a Class A license must use FCC Form 400.

Be sure to fill out the work sheet on the new form in pencil first so that any mistakes you may make can be easily erased and corrected. Then fill out the actual application form, using a typewriter. Read it over carefully upon completion, then sign it, and mail it to the "Federal Communications Commission, Gettysburg, Pa."

Although the new form has been simplified considerably and no longer requires a notary seal, you are still bound by the laws governing CB radio and are required to read and understand the provisions of a current copy of Part 19, the Citizens Radio Service Rules. This is in Volume VI of the FCC Rules and Regulations, and can be purchased by sending $1.25 to the Superintendent of

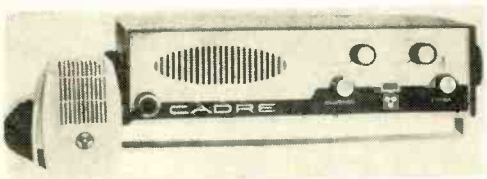
At the CB jamboree held by the Marshall (Texas) CB Club last summer, there were drawings for 47 prizes. The grand prize was a CB transceiver won by Anson G. Jones, shown here on the right. Club president Fred Sudduth is announcing the winner as Barney Woods, vice-president, makes the presentation. James Abney, secretary-treasurer, is at the left. See "Club Chatter" on page 99 for more details on the Marshall CB Club and its first jamboree. (Photo courtesy Marshall News Messenger)

Documents, Government Printing Office, Washington 25, D.C.

If there is any question in your mind regarding any part of the new FCC Form 505, read Julian (2W5115) Sienkiewicz's article, "New Form for CB," which appeared in the August, 1962, issue of POPULAR ELECTRONICS. His explanation of each phase of the new application form will all but fill it out for you.

All-Transistor Transceiver. Here's a beauty that should create a lot of "talk"! Approved by both the FCC and DOT (Canada's Department of Transport), the Cadre 510 all-transistor CB transceiver offers five crystal-controlled transmit/receive channels. With the maximum Class D transmitting power authorized by the FCC, the new 5-watt unit utilizes 18 transistors and 8 diodes, and is also adaptable for field use in its own portable power pack with rechargeable batteries. Audio power output is a full 2.5 watts.

The 510, made by the Commercial Products Division of Cadre Industries Corp., Endicott, N. Y., has been engineered for maximum channel selectivity and adjacent channel rejection. Other features include a dynamic push-to-talk microphone; a frequency stability of 0.005%; low current drain for prolonged



battery life; adjustable squelch for noise-free standby reception; and a noise limiter which automatically rejects ignition and other electrical interference for clear reception at all times. The 510 can be kept "on" safely all day with no heat problem, and no concern for tube burnout.

Finished in a brushed aluminum and charcoal styling, the Cadre transceiver has a built-in dual power supply (12 volts d.c./110-220 volts a.c.). It can easily be installed in any size or make automobile, truck, aircraft, or boat.

Walkie-Talk. Here's a boost for the little guys! A new Mark "Heliwhip" antenna for CB hand-held transceivers has been introduced by the B & K Division of the Dynascan Corp. (1801 West Bell Plaine Ave., Chicago 13, Ill.)

Designated as the HWP, and priced at $7.20, the light, flexible antenna has two lengths—12 or 18 inches. However, the HWP gives more power and greater transmission and reception range than many longer antennas. The short length also helps to eliminate antenna breakage.

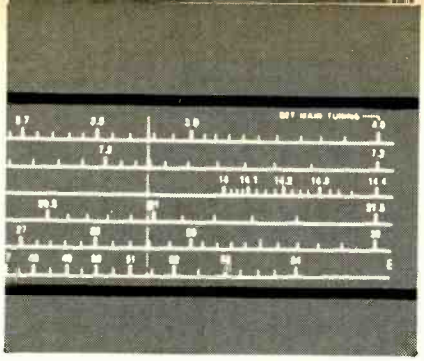
A universal base makes the HWP easy to use with any model hand-held unit. It can be mounted directly on the existing collapsed whip. Top-loaded, 50-ohm design and exclusive Mark "Static Sheath" plastic covering help insure maximum efficiency of the antenna with little interference.

More on Antennas. As you may already know, the antenna just discussed is but one of a vast number of antennas now available that are quite different from the simple quarter-wave whip, ground plane and coaxial styles which have been so popular. Many of them are "extended" types, quite a bit longer than a quarter wave. Some are even half-wave units, while others are ⅜-wavelength long. Just how do they work?

If we examine a half-wave or ⅜-wave vertical antenna, we find that the input impedance of such a device can be rather complex. A nice, simple, half-wave horizontal antenna, center-fed, exhibits a nice, simple, 72-ohm, pure resistive impedance at the frequency for which it is cut. The impedance of a vertical half- or ⅜-wave antenna, on the other hand, is made up of capacitive and inductive components; it can be difficult, if not impossible, to nail down at one particular value—especially a value which will match the output of a standard transceiver.

The answer lies in the "matching" device used by the manufacturer. Whether it be a coil, series capacitor, or a combination of both, you can be certain that

(*Continued on page* 98)



Across the Ham Bands

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

WHAT SWR'S ARE ALL ABOUT

WHENEVER hams talk about antennas, you hear a lot about standing waves and standing wave ratios (SWR's). Everyone will agree that a low SWR—sometimes referred to as VSWR or voltage standing wave ratio—is good and that a high SWR is bad. But the meaning of these terms is not well understood by many hams.

Radio-frequency transmission lines all have characteristic impedances, determined by their construction. For example, the nominal impedance of RG-8/U and RG-58/U is 52 and 53.5 ohms respectively; that of common TV twin-lead is 300 ohms, and that of air-insulated two-wire transmission line is usually between 400 and 700 ohms.

If you connect a transmitter to one end of a transmission line and a load equal to the line impedance to the other end—such as a 50-ohm load to a 50-ohm line—there is a perfect match between the two and the SWR is said to be 1:1. This is true whether the load is a 50-ohm resistor or an antenna with the equivalent resistance of 50 ohms. So, for any other value of load resistance, there is obviously a mismatch between line and load.

A mismatching of line and load results in the load accepting part of the power traveling up the line from the transmitter (incident power) and the remainder being reflected back down the line (reflected power). These incident and reflected waves traveling simultaneously in opposite directions on the transmission line produce standing waves of voltage and current every ½ wavelength from the antenna end of the line. The ratio between the maximum and minimum values of these incident and reflected waves is called the "standing wave ratio."

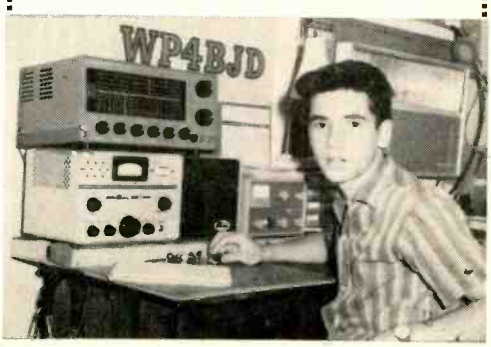
To calculate the SWR, you can use the formula: SWR $= (E_1 + E_2)/(E_1 - E_2)$; where E_1 is the voltage of the incident wave and E_2 is the voltage of the reflected wave. This formula will also hold true for SWR calculations using incident and reflected current, instead of voltage.

Due to natural line losses, SWR's at the load end of the transmission line are greater than at the end nearest the sig-

···Novice Station of the Month···

This month's prize-winning photograph comes from Santurce, Puerto Rico. It was sent in by Gabriel Fuentes, III, WP4BJD, who can testify that having a "rare" call-sign really helps. In two months, he has made over 200 contacts, and the QSL cards are still rolling in! Gabe's equipment includes an EICO 723 transmitter; two receivers—a Mosley CM-1 and a Lafayette HE-30; and two antennas—a 2-element, 15-meter beam and a vertical.

Gabe will receive a one-year free subscription to P.E. for his photo. If you would like to try for a similar award, send us a picture of your station—preferably showing you at the controls, and include with your entry some information about yourself, your equipment, and your activities. You may be one of the lucky winners. Non-prize-winning photos will also be published as space permits. Entries should be sent to Herb S. Brier, Amateur Radio Editor, POPULAR ELECTRONICS, P.O. Box 678, Gary, Indiana.



If you've been finding it difficult to make contacts in Nevada, and wondering if there really are any hams there, these photos of Tony Morgan, KN7TRG (below), and Bill Gotwalt, KN7TNY (right), should remove any doubt. They mail their QSL cards from Las Vegas. (See News and Views item on page 97.)

nal source. Thus, in order to get a true picture of the SWR, measurements should be taken as close to the load end as possible.

All transmission lines have some natural line losses, which are at a minimum when the line is matched and increase as the SWR increases. High SWR's also tend to decrease the power that a line can safely handle. It is for these reasons that lines should be matched and SWR's held to a minimum.

Learning *all* about standing waves requires a lot of "hairy" mathematics and r.f. transmission line theory—which really isn't necessary to get the most out of your antenna feed system. However, if you do want to go into the subject in greater detail than we have done here, there are a number of good books available on the subject—such as the ARRL "Antenna Handbook."

Navy MARS. The Director of Naval Communications, Rear Admiral Bernard F. Roeder, has recently announced plans to organize a Navy Military Affiliate Radio System (Navy MARS) similar to existing Army and Air Force MARS. If you are interested, write to the Director, Navy MARS, Office of Naval Communications (OP-94), the Pentagon, Washington 25, D. C., and ask for further information.

Keying Monitor. As do most hams who operate primarily on c.w., you probably use your receiver, instead of a keying monitor, to tell whether or not your transmitter is keyed. This usually works pretty well when you're on the frequency of the station being worked, but things get a bit complicated when the two stations are on different frequencies. A keying monitor would solve your problem.

The odd thing is that you may already have a good keying monitor around without even realizing it. If you have a small BC receiver in the shack, try placing it near your transmitter and carefully tune it as you key the transmitter. Chances are you'll hear the transmitter's signal at umpteen spots on the receiver dial. Presto! You've got a keying monitor.

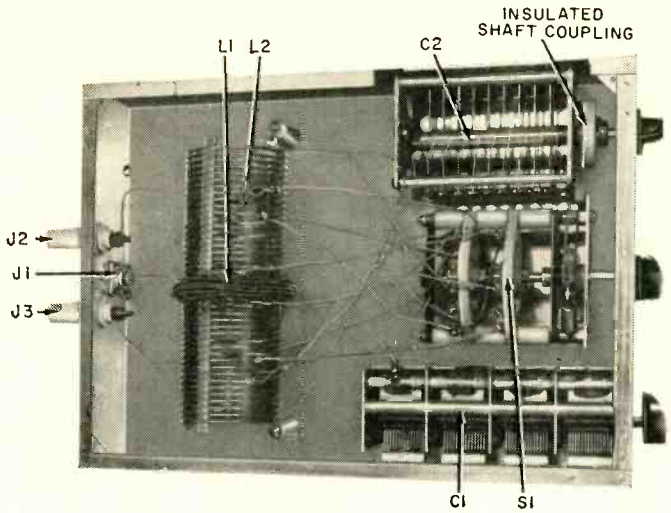
The theory behind this little trick is that the transmitter's signal beats with the harmonics of the receiver oscillator to produce "difference" signals at various points on the receiver dial. Because the receiver oscillator harmonics are quite weak, the receiver must be placed close to the transmitter to produce usable beats.

Our thanks go to Perry Gorchov, WN4FRO, for reminding us of a monitoring system we hadn't thought of for years.

MULTI-BAND ANTENNA COUPLER

The bandswitching (3.5- to 29.7-mc.) antenna coupler described here this month is an improved version of a coupler which was covered in a previous "Across the Ham Bands" column (August, 1961). This improved coupler (see photo) will feed r.f. power into virtually any ham antenna—long-wire, multiband doublet, etc.—and at the same time match the impedance of the antenna to the 50- to 75-ohm output impedance of most ham transmitters.

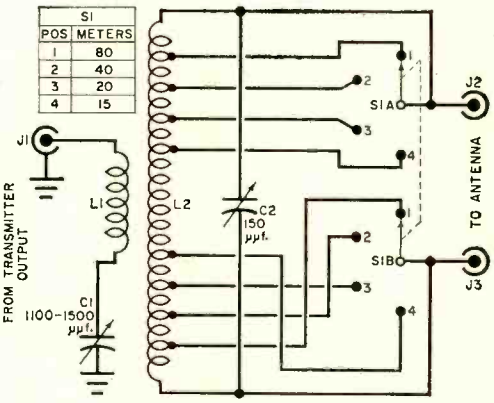
Switch *S1* and capacitor *C2* are designed to handle the r.f. power of a 500-



Capacitor C1 is a 4-ganged unit in the multi-band antenna coupler shown here, but any variable capacitor with a rating of 1100-1500 $\mu\mu$f. will do. Also note the use of insulated shaft coupling for capacitor C2.

PARTS LIST

C1—1100-1500 μμf. variable capacitor (Miller 2113 with 3 ganged 365-μμf. sections wired in parallel, or equivalent)
C2—150-μμf. variable capacitor (E.F. Johnson 150E45 or equivalent)
L1—7 turns of #14 enameled wire wound over center of L2—see text
L2—46 turns of #12 wire, 2½" in diameter, 6 turns per inch (B&W 3905-1 or equivalent)
S1—2-pole, 2-section, 4-position ceramic switch (Centralab 2005 or equivalent)
J1—Chassis-type coaxial connector (Amphenol 83-1R or equivalent)
J2, J3—Feedthrough insulator (E.F. Johnson 135-40 or equivalent)
1—10" x 14" x 3" aluminum chassis (Bud AC-414 or equivalent)
1—1½" x 1" x 1/16" plastic sheet, to be cut into four 1" x 3/8" x 1/16" strips—see text
Misc.—Stand-off insulators, knobs, #14 wire, coil clips, shaft couplings, hardware, Duco cement, etc.



Because of the number of taps on coil L2, be especially careful to dress the leads so they won't short to the coupler chassis or to each other.

watt, plate-modulated AM transmitter, a 1000-watt c.w. transmitter, or a 2000-watt SSB transmitter. However, for transmitters of lesser power, *S1* and *C2* can be replaced by parts with lower ratings, which will also offer a saving in space.

Construction. The interior of a standard 10" x 14" x 3" chassis will accommodate the parts of the coupler handily. A similar chassis can be used, if desired, as a shield and dust cover.

Before mounting coil *L2*, cement four plastic strips, approximately 1" x 3/8" x 1/16" (cut from the cover of a plastic parts or similar box), to the plastic ribs at the center of the coil. Wind coil *L1* over these ribs and hold it in place with additional cement, making sure that the two coils don't short together. Now wire the unit as shown in the schematic, but leave the wires from switch *S1* to coil *L2* unattached for the present. (These #14 enameled wires should be about 10" long and will be connected later.)

It is very important that care be taken during the adjustment procedure that follows. The transmitter, which is turned on for certain measurements to be taken, *MUST BE TURNED OFF* for the adjustment of the coil clips. Failure to follow this procedure can result in a *lethal shock.*

(*Continued on page* 96)

Transistor Topics

By **LOU GARNER,** Semiconductor Editor

ACCORDING to the calendar, it is once again time for your Semiconductor Editor to tote up his "score" on the predictions he made for the year just ended. And it is also the time when he traditionally sticks out his editorial neck in making new predictions for the year ahead.

First, let's take a look at last year's score, baseball fashion. In January, 1962, we predicted:

● Tunnel diodes at tube prices or less —*home run*—according to a late catalog, tunnel diode types 1N3651 and 1N3652 net for *under* $2.50 each; by comparison, many receiving tubes net for over $2.50, with types such as the 6AN4, 6BG6-G, and 12AL8 selling for over $3.00.

● Transistorized CD gear for fallout shelters and personal use—*home run*—a number of such units have been offered, but with the general decline of interest in fallout shelters, there was a corresponding lack of interest in protective instruments.

● A transistorized stereostethoscope for doctors—*home run*—such an instrument is now being produced by MED Electronics, Alexandria, Va.

● High-frequency, medium-power transistors for under $5.00—*home run*—types 2N337 and 2N706 have good r.f. characteristics and power ratings in excess of 100 mw., yet both net for under $5.00 each, according to Lafayette's latest catalog.

● Silicon transistors for hobbyists at prices under $2.00—*home run*—Texas Instruments' TI-480, TI-481, TI-492, TI-493, and TI-496 are all silicon types, and all net for under $2.00 each in small quantities.

● A medium-priced (under $350.00) transistorized oscilloscope—*strike out*—I'm afraid I was too optimistic on this particular item.

● A new type of transistor or semiconductor device based on the use of crystalline carbon (diamond)—*double*—such a device has been developed, but has not yet been placed in commercial production.

● An increase in the use of transistors in hi-fi equipment—*home run*—Harman-Kardon, Heath, Knight (Allied Radio), Lafayette Radio, Radio Shack, and Transi-Tronics are but a few of the firms offering transistorized stereo amplifiers, and several firms are producing transistorized FM tuners.

● A drop in the number of firms offering transistorized CB "walkie-talkies"—*double*—while a variety of these units are being offered, many are imports rather than of domestic manufacture. A number of U. S. firms have discontinued production of these instruments, as predicted, due primarily to the competition offered by low-cost imports.

● The introduction of a transistorized personal small-arms detector—*home run*—such a unit is now in production and is available to police officers, detectives, the military, and industrial security guards.

● A U.S.-sponsored "moon-shot" carrying a transistorized TV camera—*triple*—such a "shot" was made, but unfortunately the clock circuits failed, so we hesitate to score a "homer" here.

Total score: one strike-out, two doubles, one triple, and seven home runs in eleven times at bat. Pretty fair in most leagues!

Things To Come. There appears to be a slight crack in my trusty crystal ball, but anyway here goes!

In 1963, watch for: *an increased use*

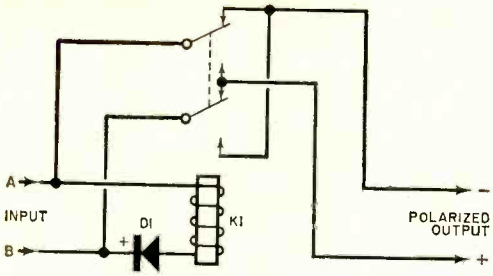


Fig. 1. Modified "polarity reverser" suggested by readers Dave Coleman and Dr. Joseph B. Rogoff.

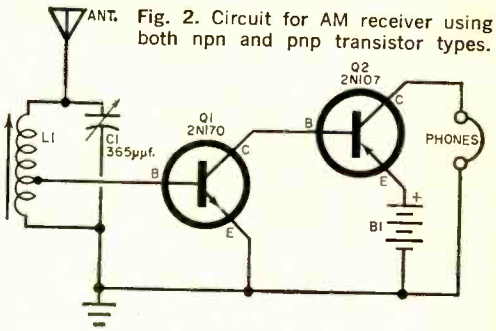


Fig. 2. Circuit for AM receiver using both npn and pnp transistor types.

of field effect transistors, with moderate-price units available for hobbyists . . . the introduction of a fully transistorized integrated FM-stereo tuner and stereo amplifier . . . *tunnel diodes selling for less than one dollar* . . . production of a transistorized ultra-violet flashlight . . . *development of a completely new semiconductor device, neither transistor nor conventional diode* . . . an upswing in the use of integrated and modular circuits, among hobbyists as well as manufacturers . . . *the production of "jewelry-type" transistorized products—receivers, for example, suitable for use as dress accessories* . . . introduction of a variety of solid-state automobile accessories, both as standard and optional equipment for 1964 models, including a greatly increased use of transistorized ignition systems . . . *new semiconductor-operated appliances and controls for the home* . . . and the introduction of a transistorized intrusion alarm system which utilizes an entirely new principle of operation!

Readers' Circuits. We've received notes from a number of readers suggesting a modification in the "polarity reverser" circuit submitted by Don Petro and featured in our July 1962 column. As you may recall, Don's circuit was designed to insure the application of proper d.c. polarity to inverter and power converter circuits, regardless of the polarity of the power source.

The most popular circuit submitted is illustrated in Fig. 1. This arrangement was suggested by a number of readers, including Dave Coleman (12th Ave. and Russ Blvd., San Diego 2, Calif.), who is an electronics instructor at the San Diego High School; and Joseph B. Rogoff, M.D. (136 W. 16th St., New York 11, N.Y.).

The circuit's operation is quite easy to follow. Assume, first, that the source voltage is applied so that terminal "A" is negative and terminal "B" positive. In this case, the diode (*D1*) is biased in its non-conducting direction, and little or no current can flow through the relay. The relay remains "open," as shown, and the negative input terminal is connected to the negative output terminal—that is, terminal "A" to the "—" output terminal. Similarly, terminal "B" is connected through the relay contacts to the "+" output terminal.

Suppose, now, that the source voltage is applied so that terminal "A" is positive and terminal "B" is negative. In this case, *D1* is biased in its forward direction and the relay closes. Again, the positive input terminal ("A" in this case) is connected to the "+" output terminal and the negative input terminal ("B") to the "—" output terminal.

The unit itself can be assembled in a small Minibox or similar case, with the choice of relay and diode depending on supply voltage and currents to be handled. Typically, a Potter & Brumfield MR11D relay might be used, along with a 10B4 silicon diode (International Rectifier).

Complementary circuits are quite fascinating. Utilizing the similar but opposite characteristics of *npn* and *pnp* transistors, these circuits permit multistage, direct-coupled arrangements with a minimum of components. This month we are featuring two such circuits—a simple receiver and an easily built code practice oscillator (CPO).

Submitted by reader Peter Blicher (345 Judges Lane, N. Plainfield, N.J.), the receiver circuit illustrated in Fig. 2 is designed to tune the AM broadcast

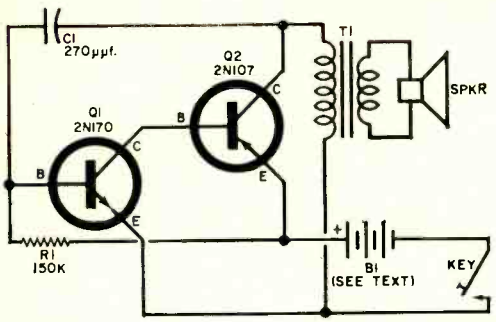


Fig. 3. Two-transistor code practice oscillator circuit submitted by reader Bill Mayette. The device operates a speaker, and changing the value of feedback capacitor C1 will vary its pitch or "tone."

band. Coil *L1* is a standard transistor ferrite loopstick antenna coil (such as Lafayette MS-299), *C1* a conventional 365-$\mu\mu$f. tuning capacitor, *Q1* a 2N170 *npn* transistor, and *Q2* a 2N107 *pnp* unit. Standard, moderate-impedance (500 to 5000 ohm) headphones are used, while the 4.5- to 6-volt battery (*B1*) can be a single unit or several penlight cells connected in series. A moderately long external antenna is required for maximum sensitivity.

In operation, r.f. signals picked up by the antenna are selected by tuned circuit *L1/C1* and applied to *Q1*, which serves both as a detector and audio amplifier, and, in addition, provides *Q2*'s base bias current. Transistor *Q1*'s output signal is amplified further by *Q2* and applied to the headphones which serve as *Q2*'s collector load.

The receiver itself can be assembled on a small chassis, on an etched circuit board, or on a fiber or plastic base, depending on individual preferences. Neither circuit layout nor lead dress should be critical.

The CPO circuit shown in Fig. 3 was submitted by reader Bill Mayette (8710 Wilson Ave., Baltimore 14, Md.). Designed for speaker operation, Bill's circuit employs *npn* (*Q1*) and *pnp* (*Q2*) transistors in a direct-coupled, complementary configuration. With this arrangement, *Q2*'s base/emitter circuit serves as *Q1*'s collector load, while *Q2*'s base bias is furnished through *Q1*'s emitter/collector circuit.

In operation, *Q1*'s base bias is furnished through *R1*, while *T1*'s primary winding serves as *Q2*'s collector load. Capacitor *C1* provides the feedback needed to start and sustain oscillation; operating power is furnished by *B1*, controlled by the key.

Standard components are used in this device. Transistor *Q1* is a 2N170; *Q2*, a 2N107. The output transformer, *T1*, is a UTC Type SSO-10 or equivalent. Resistor *R1* is a ½-watt unit, and *C1* is a small disc ceramic capacitor. Bill indicates that he has used battery voltages ranging from 0.5 to 4.5 volts without difficulty, but he recommends that the higher voltage be used for maximum volume. Any PM speaker with a 3-4 ohm voice coil is suitable, although the larger speakers are generally more efficient.

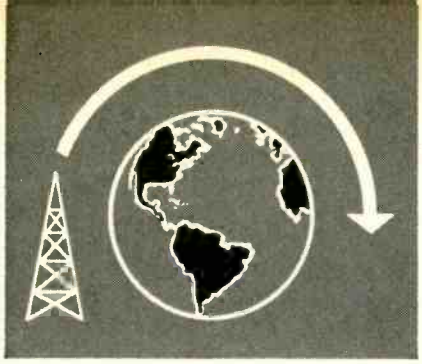
A number of circuit changes can be made to suit individual needs. Transistors *Q1* and *Q2* may be interchanged, for example, *if the battery polarity is reversed.* The instrument's tone (pitch) can be changed by using larger or smaller values for *C1*. In addition, *R1*'s value has a definite effect on tone; if you wish, you can replace this component with a 100,000-ohm fixed resistor in series with a 50,000-ohm potentiometer to provide a continuous "pitch" control.

Modules, Anyone? Our prediction of an increased use of modular circuits by hobbyists (see p. 81) is well on its way to reality with the introduction of self-contained transistorized AM tuner and audio amplifier modules by Lafayette Radio (111 Jericho Turnpike, Syosset, L.I., N.Y.) and Winco Electronics, Inc. (10807 Lyndon Ave., Detroit 38, Mich.), respectively. Both units are designed to be used alone or in combination with other modules, depending on individual needs.

The Lafayette tuner, Model PK-633, is essentially a three-transistor superheterodyne circuit covering the AM broadcast band. It comes completely assembled on an etched circuit board, including a large tuning dial and built-in ferrite antenna. Designed for operation on a standard 9-volt battery, the PK-633 measures 2″ x 4″ x 1¾″ overall with its mounting brackets. It sells for $7.95, plus postage.

Dubbed the "Mity-Amp," the Winco audio amplifier module is an encapsulated unit measuring approximately 2″ x 3½″ x ⅞″ overall. Designed for opera-

(*Continued on page* 110)



Monthly Short-Wave Report

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

SHORT-WAVE STATIONS OF BOLIVIA

BOLIVIA is one of the most difficult of the South American countries to log on the short waves. The fact that there are only a handful of stations on the air, coupled with an almost complete absence of English, makes the problem of identifying these stations a trying one. The following is a special report containing a few tips that may help you to log some of them.

This report was compiled by Jack Perolo, PY2PE1C, Sao Paulo, Brazil, who recently supplied us with a Guatemala station listing (see May and June, 1962, issues). Since virtually all of the stations below broadcast in Spanish, it is recommended that you tune very carefully for the slogans during station breaks. The number, in each case, indicates the frequency in kilocycles.

4785 *R. Indoamerica,* CP-53, Potosi. Still unlisted in 1962 *World Radio Handbook,* but logged as early as mid-1961 on 6202 kc. Recent tuning shows world news bulletin in Spanish at 2131, Latin American pop tunes to 2206 s/off. At times, call of CP-54 may be given. Heavy Morse QRM usually encountered on this frequency. Two reports to station not verified.

4826 *R. Grigota,* CP-24, Santa Cruz de la Sierra. Heard since last February with many commercials and Latin American pop tunes. Programs often relayed from local theaters or gymnasiums on Sundays. S/off between 2200 and 2230 with consistently good signal but with QRM at times from Rhodesia on 4828 kc. ID infrequent; may, at times, be given as CP-70.

4985 *R. La Cruz del Sur,* CP-75, La Paz. Noted around 0000 mostly with religious programs. Power: 5 kw., days; 10 kw., nights. Schedule reads: Sundays at 0615-2200; weekdays at 0600-1300 and 1730-2200. No mention made recently of 15,390-kc. channel announced by station early in 1962 as opening in June, 1962; nor has new channel been heard. Verification by letter.

5757 *R. Sumajorco,* Potosi. Noted on this frequency despite announced frequency of 5750 kc. No call heard. S/off time very seldom varies from 2200-2202. All-Spanish, pop tunes featured, no commercials. S/on time given as 0400. Unverified after three reports.

5860 *R. Nacional,* La Paz. One of the best Bolivian signals. Only Latin American pop tunes, request or greeting programs, political talks presented; no commercials; all-Spanish. ID and time check given on the half hour, heard to as late as 2245. No veries after four reports.

5955 *R. Pio XII,* Siglo XX. On the air since mid-1961. Formerly on 5980 kc.; now listed as being on 5950 kc. All-Spanish, with very few ID's. World news given at 1825; close at 2300. Reports in 1961 verified.

5962 *R. Corocoro,* Corocoro. Opened in July, 1962; rather weak signal. Dance

Paul Pietras, WPE1DBH, of East Greenwich, R.I., does his DX'ing with a Hallicrafters S-38E receiver and a 75′ long-wire antenna. To date, WPE1DBH has logged 50 countries.

Equipment in the listening post of Luther (WPE3DLV) and Richard (WPE3DVM) Knight, of Baltimore, Md., includes two Hallicrafters receivers—an S-120 and an S-95 "Civic Patrol." Their antennas are a 66' doublet and a 50' long-wire. The two Knights have a record of 8 countries vertified out of 17 heard.

music heard around 2140. S/off time varies from 2205 to 2210.

6125 *R. El Condor,* CP-15 (new address: Av. Camacho 1471, La Paz). Caution needed in logging; they may often ID as *R. Universidad,* Potosi. ID and time check given on the half hour. Their slogan—*La Voz del Ferroviario*—also used by other stations. Normal s/off time is 2335, with full ID and IS consisting of a starting steam locomotive. S/on time listed as 0600. Verification received not stating power but informing that s/on time is later on Mondays, Wednesdays, and Fridays because of power limitations—which may explain why their signal fades so badly.

6270 *R. Amauta,* CP-9 (new address: Casilla 586, La Paz; Lucy Saavedra Perez, Director). Closes daily at 2220 after news bulletin at 2200 and world news at 2215. May drift to as low as 6256 kc. near closing time. Verification, after two reports, listed power as 850 watts.

6301 *R. Libertad,* CP-30, Santa Cruz de la Sierra (new address: Casilla 543). Widely reported despite low power of 150 watts. Slogan: *La Voz de los Trabajadores.* May drift as high as 6307 kc. Daily s/off, 2200-2205.

9200 *R. Sucre,* Sucre. Back on the air after being off for almost a year. Noted Sundays from 1540 with children's show, followed by newscast in Spanish. S/off time, 1730; return at 1800 announced. Also noted irregularly during the week around 2100 with commercials and pop tunes. Extremely difficult to tune due to drifting.

Many thanks to PY2PE1C for supplying us with the data on the above stations. For information on CP-38, which

(*Continued on page* 112)

ENGLISH-LANGUAGE NEWSCASTS TO NORTH AMERICA

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

COUNTRY	STATION	FREQUENCY *(kc.)*	TIMES *(EST)*
Australia	Melbourne	17,840, 15,315	2030, 2130, 2230
Bulgaria	Sofia	9700	1900, 2000, 2300
Czechoslovakia	Prague	15,285, 11,990, 9795, 9550, 7345	2000, 2330[1]
Denmark	Copenhagen	9520	2100, 2230
East Congo	Leopoldville	11,755	1630, 2100, 2230
Hungary	Budapest	11,890, 9833, 9770	1900
		9833, 9770, 7220	2230
Italy	Rome	11,905, 9575	1930, 2205
Lebanon	Beirut	15,295	1600
Netherlands	Hilversum	11,730, 9715, 6020	1630 (ex. Sun.)
		6035, 5985	2030 (ex. Sun.)
Portugal	Lisbon	9740, 6025	2105, 2305
Spain	Madrid	9360, 6130	2215, 2315, 0015
Sweden	Stockholm	17,840	0900
		11,805	2045, 2215
Switzerland	Berne	11,865, 9535, 6165	2030, 2315
USSR	Moscow	12,030, 11,960,11,870, 11,820, 11,730, 9720, 9680, 9650, 9630, 9620, 9570, 7320, 7290, 7180, 7170, 7150[2]	1700, 1900, 2000, 2100, 2300, 0000, 0040
West Congo	Brazzaville	11,725	2015
West Germany	Cologne	11,795, 9735	1530
		9605, 6145,	1920
		9735, 6110	0000

1. At 2330, 11,745 kc. replaces 15,285 kc. 2. Not all channels are in use at any one time.

Stereotaped New Year

a Carl and Jerry Adventure

IT WAS early afternoon on the last day of the year. Carl and Jerry, home from college for the holidays, were lounging in the living room of their favorite young-woman neighbor, listening to the stereo tape recorder she had received for Christmas.

"That's certainly a fine recorder, Norma," Jerry said when the prerecorded tape ended and she switched off the instrument.

"Yep," Carl agreed, his words a little blurred by a mouthful of Norma's homemade fudge, "that stereo really makes everything sound alive and real and right here—say, there goes Mr. Gruber for his walk. Do Jerry and I imagine it, or has our old friend lost some of his zing lately?

"I've always admired him for being such a non-typical old man," Carl went on, before Norma had a chance to answer. "None of that living-in-the-past stuff for him. Instead of reading the obituary and the 'fifty-years-ago' columns, he reads science-fiction; and he knows more about recent developments in space exploration than either of us. We both feel, though, that he isn't himself this vacation. He hasn't been picking our brains for things we've learned in the labs down at Parvoo, and he showed only faint interest in the university's new nuclear reactor. That just isn't Mr. Gruber."

"I intended to talk to you about him," Norma said. "For one thing, he misses you fellows a lot when you're away at school. On top of that, the bad winter weather has kept him cooped up in the house. At any rate, there has been a change in his outlook. I didn't realize how much of a change until Mrs. Gruber told me yesterday that he isn't going to stay up tonight and welcome the new year in. He says New Year's Eve celebrations are for young people with a future ahead of them, not for old people who have only the past. You both know what an enthusiastic holiday-keeper he has always been up to now."

"I'll say!" Jerry exclaimed. "It just won't be New Year's Eve if Mr. Gruber doesn't turn loose that old 10-gauge Baker shotgun of his at the stroke of midnight. He's been shooting it off ever since I can remember. This is serious. We've got to do something about it."

"I'm not sure there's anything we can do," Norma replied. "Mrs. Gruber is plenty worried, and she has done her

By
JOHN T. FRYE
W9EGV

best to talk him out of this mood with absolutely no success."

"It will take more than talk," Jerry said slowly and thoughtfully. "But I've got a kind of half-baked idea. You have any plans for tonight, Norma?"

"None I won't cancel to get in on one of those fiendish schemes you two dream up," she said promptly. "Some of the girls from the office are planning on taking in a midnight show, but you can count me in on anything you have in mind for Mr. Gruber."

"Good! The first thing I want you to do is snag Mr. Gruber when he returns from his walk and hang on to him for at least an hour. Think you can do that?"

"Oh, I guess my feminine charms, backed up by a big plate of Toll House cookies, might rise to the occasion. What are you two going to be doing?"

"We'll be making a few changes in Mr. Gruber's room. Carl, you get those powerful little speakers from the stereo system in your room and bring them over to the Grubers' while I pave the way with Mrs. Gruber. Also get that roll of twisted-pair from the lab, and bring along an intercom speaker."

He was putting on his coat while issuing these instructions, and soon both boys were gone, leaving Norma watching out her front window for the return of Mr. Gruber.

JERRY quickly outlined his plan to Mrs. Gruber, and she agreed to it gladly without understanding a word of what he said. Carl came in the back door with a compact speaker cabinet under each arm, and the two boys went upstairs to Mr. Gruber's room.

One of the matched speakers was placed behind some boxes on the floor of a clothes closet, the door of which was normally left open. The other was hidden behind the curtain of a bookcase sitting against the opposite wall. The intercom speaker/mike was placed beneath the bed. Leads from all three speakers were concealed beneath rugs and along baseboards until they fed out through the window and then across to Carl's bedroom window that was directly opposite it.

Heavy gray clouds, carrying a promise of snow, had started rolling in from the southwest; and dusk came early. In fact, it was growing quite dark as the boys went out the back door and across the yards to the entrance of their basement laboratory. Just as they started down the steps, they saw Mr. Gruber come out of Norma's house and head for home.

Norma came over to Carl's right after supper, bringing her new tape recorder with her. The boys had been busy rounding up some stereo sound-effect records from their friends, and soon the three of them were busily engaged in a recording session. The session was interrupted twice for mysterious missions. Once Jerry scurried over to his house and came back with a basketball in the hollow of his arm. Another time Norma went home

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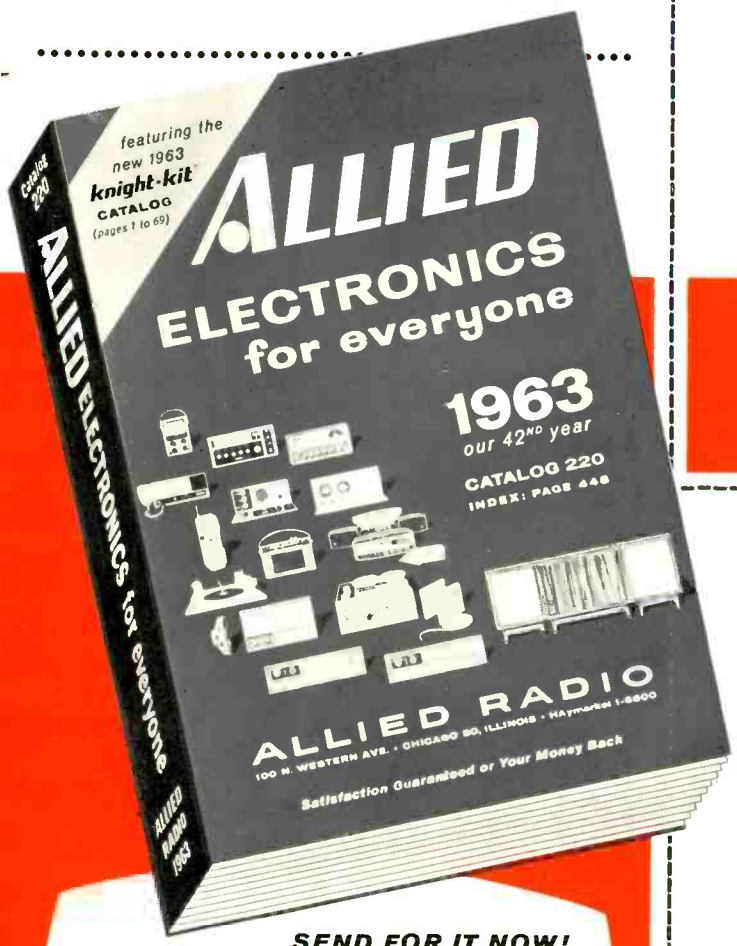

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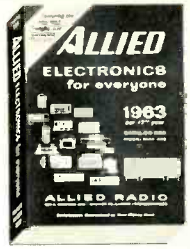

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and returned giggling and carrying her best pair of dress-up spike heels.

Some of the sound effects were transcribed from the records onto the tape, using Carl's stereo pickup and his stereo preamplifier. Other sections of the tape were recorded "live," using both mikes. The latter required quite a bit of experimenting and redoing to get exactly the effect desired; so time slipped past quickly.

It was just eleven o'clock when Carl and Jerry were finally satisfied with what they had on the tape, and it was then that the light came on in Mr. Gruber's window across the way. He was all ready for bed, attired in an old-fashioned nightshirt.

After raising his window a bit, Mr. Gruber got into bed, took off his glasses and placed them on a table beside his pillow, and turned out the light. Through the sensitive intercom speaker/mike, the three young people in Carl's room could hear the old man's regular breathing.

Carl plugged a pair of earphones into the intercom unit so that Norma could listen on one of them while he monitored with the other. Jerry started the tape recorder that was feeding the twin stereo amplifiers. The output of these amplifiers was now connected to the two matched speakers installed in Mr. Gruber's room.

Through the earphones, Norma and Carl heard the plop-plop-plop of approaching hoofbeats. They grew louder and louder and then slowly faded out. That is the way it sounded over the earphones, but they knew that in Mr. Gruber's room the stereo effect from the two separated speakers would make it sound exactly as though a horse had walked through the wall of the clothes closet, had plodded across the floor into the bookcase, and then had gone on through the wall and away.

The light snapped on in Mr. Gruber's bedroom, and they could see him fumbling for his glasses. He had barely put them on when an invisible player began bouncing a basketball on the floor in his clothes closet. Very deliberately this ghostly athlete dribbled the ball out across the floor of the bedroom to the bookcase, bounced it a few times there, and then turned around and dribbled it back into the clothes closet. Mr. Gruber's nodding head followed every movement of the invisible player.

The ball had scarcely ceased whumping the floor when the distant lonely whistle of a locomotive came faintly into the bedroom. Rapidly the puffing of the steam exhaust and the clatter of iron wheels on the rails increased in volume until, with a roar and a Doppler-modulated shriek of the whistle, the unseen train drove straight out of the wall behind the bookcase, ran across the room into the clothes closet, and kept right on going. Involuntarily Mr. Gruber shrank back to let the train pass.

As the clatter of the train died away in the distance, another interesting sound filled the room—a most intriguing sound to masculine ears. It was that of a young woman's high heels clicking along on a hard surface. She marched straight to the door of the clothes closet and then broke into a little run as she dashed over to the bookcase, where she stopped. Over in Carl's darkened room, Jerry stopped the tape recorder and switched in a live mike in front of Norma.

"Come now, Mr. Gruber!" she said throatily. "What are you doing lying up here in bed when the New Year is waiting for you to welcome it?"

Jerry cut Norma's mike and turned up another in front of Carl.

"Come on downstairs and join the party," Carl's voice urged from the clothes closet. "It's almost New Year's Eve!"

In one continuous movement Mr. Gruber threw off the covers and put his feet on the floor. He ran over and pulled back the curtain of the bookcase, revealing the concealed speaker. Then he went into the clothes closet and soon discovered the other unit and the wires leading away from it. Returning to the middle of the room and looking across at Carl's darkened window, he said with a grin:

"All right, you young rascals; I'm sure you can hear me. Wait until I get some duds on and I'll be down. I might as well. I'd like to see the color of a man's hair who could sleep in this room tonight!"

THE three young people dashed across the back yards to the Grubers' back door, where Mrs. Gruber, laughing hap-

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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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- ☐ Send me FREE additional information describing "Edu-Kits."

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.....

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1186 Broadway, Dept. 600D, Hewlett, N. Y.

pily, let them in out of the snow that was just starting to come down. A few seconds later, Mr. Gruber, looking a little sheepish but still smiling good-naturedly, came down the stairs.

Just as he reached the bottom of the stairway, Mr. Gruber glanced at the clock on the mantel and then made a quick dive into the front-hall closet. He emerged carrying a long-barreled shotgun, and all of them followed him out onto the front step. Pointing the muzzle up into the swirling snowflakes, Mr. Gruber pulled the trigger; and the 10-gauge Baker went off with a full-throated roar.

"Happy New Year!" Mr. Gruber shouted as he grabbed his wife and kissed her soundly.

They all stood out there in the snow, shaking hands and embracing each other while the whistles and the bells and the ragged popping of guns marked the end of one year and the beginning of another. The Grubers laughed heartily as Norma told how the boys had her mincing up and down past the mikes in her high heels while they made a recording. Finally they filed back into the house where Mrs. Gruber had prepared a midnight lunch.

"Martha," Mr. Gruber said in high good spirits, heading for the cellar stairs, "this occasion calls for a bottle of my wine."

Every fall when the grapes turned purple, Mr. Gruber liked to fancy himself as "that little old wine-maker," and he made a great to-do about preparing a few bottles of the juice. Thanks to Mrs. Gruber's close supervision, the brew was most innocuous. When their glasses were filled, Mr. Gruber raised his and made a little speech:

"Let's drink to this New Year and many more to come. Martha and I have seen lots of New Year's Eves, many pretty much the same; but there certainly is nothing stereotyped about this happy stereotaped one I thought was going to be so dismal.

"You, my young friends, have taught me a lesson. Beginnings are for everyone, not just the young. Life is a mystery story, and who will say that turning a page near the back of such a book, where the mystery is being cleared away, is not as interesting as turning a page at the front? From here on in, that old 10-gauge Baker and I will be waiting eagerly to welcome each new year!"

"Hear! Hear!" the young people chorused as they touched their glasses to his. —30—

5 Progressive Technical Advances created the General MC5

The World's most advanced 11 meter two-way radio

3.25 watts minimum output. • High level modulation [illegible] unparalleled talk power. • New Zener D[illegible] gated limiter [illegible]

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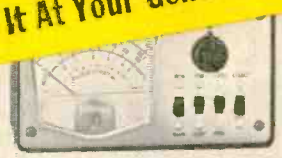
[illegible] "S" Meter. [illegible]operation. • 15 watt construction. [illegible]ace including microphone and crystal . . . $199.95. Optional accessories available. 6 Volt or 12 Volt cord, each $4.95. Crystal T or R, each $2.95. 90 day warranty. F.O.B. Burbank, California.

Under present rules part 19.32 the FCC does not provide for more than five (5) watt input in the Citizens Radio Service (26.965-27.225 MC Band)



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NEW 3-WAY ACOUSTIC SUSPENSION SPEAKER KIT... exclusive Heathkit version of the Acoustic Research AR-2A; 10" woofer, two 5" mid-range speakers, and 3-1/2" super-tweeter. Low distortion, astounding range of ±5 db 40 to 20,000 cps. Factory built cabinet, walnut or unfinished. Shipping February.

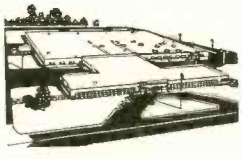
Kit AS-2AW,.....**$99.95;**
AS-2AU,.....**$89.95**

NEW 4-TRACK PORTABLE STEREO TAPE RECORDER KIT... exclusive Heathkit with rugged tape mechanism lauded by Audio magazine, Nov., 1962. Includes stereo amplifier and two detachable speaker wings, each with 5" woofer and 3" tweeter. Handsome tan and ivory cabinet.

Kit AD-72,.....**$198.00**

NEW LOW-COST 25-WATT MARINE RADIO-TELEPHONE PACKAGE... ideal for outboards, runabouts. 5 channels plus broadcast band receiver coverage. Factory built and tuned, just connect battery and use. Includes antenna and all accessories. Assembled . . .

MWW-13S, 19 lbs., **$189.95**



who is Heathkit?

Heathkit is the pioneer and world's largest manufacturer devoted exclusively to the design and manufacture of do-it-yourself electronic kits. All our efforts are aimed at creating more kits, better kits, easier-to-build kits.

what are Heathkits?

Heathkits are electronic equipment in un-assembled form. All parts are packaged in convenient groups and a complete, easy-to-read, well-illustrated instruction manual tells you how to put them together. Heath offers over 250 kits from simple portable radios to big analog computers.

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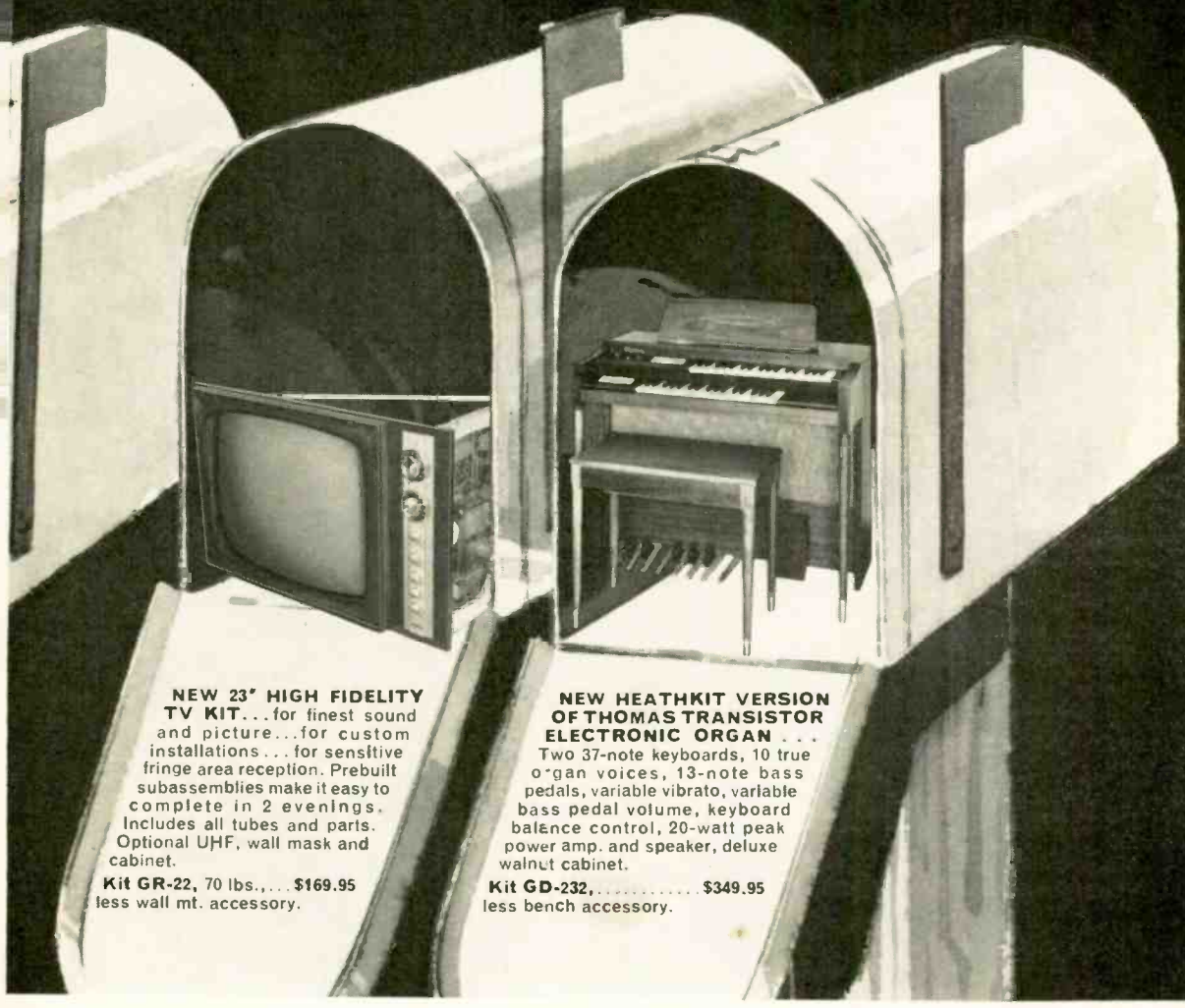
Millions build Heathkits. People with absolutely no mechanical ability or knowledge of electronics as well as skilled electronic experts—all find value, economy, fun, relaxation, and pride of accomplishment in Heathkits. You can too.

with Heathkits



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Across the Ham Bands

(*Continued from page* 79)

Adjustment. When the wiring is complete, except for the coil taps, connect the coupler to your transmitter with coaxial cable and connect your antenna to the coupler's output terminals through an SWR bridge. The SWR bridge should be connected as near the antenna as possible in order for the readings to be accurate. Therefore, it might be necessary for another person to be at the SWR bridge to relay the readings to you.

Turn the band switch to the 80-meter position and connect the 80-meter wires to coil *L2* with phosphor-bronze coil clips. Now key the transmitter and adjust the capacitors for as near a 1:1 SWR reading as possible. You'll have to turn the transmitter off and relocate the clips, to insure that you find the point on the coil that will give the best ratio. Once this point is located, turn off the transmitter, remove the coil clips from the wire, and solder the wire (after cutting it to the proper length) to the point on the coil found to offer the best ratio.

This same procedure should be followed for the 40-, 20-, and 15-meter bands. As a guide, it is suggested that you start with all the coil turns on 80 meters, 30 turns on 40 meters, 12 turns on 20 meters, and 4 turns on 15 or 10 meters.

If you are using a balanced two-wire antenna, keep the taps evenly spaced on either side of the coil center. Using a single-wire antenna, ground the end of coil *L2* which is connected to the stator of capacitor *C2*—do the same with a coaxial-fed antenna and ground the shield of the coax.

If necessary, borrow an SWR bridge to adjust the coupler, and record the capacitor settings for frequencies of interest to you.

News and Views

Roland Guidry, WN5CHX, Box 249, Duson, La., doesn't let a low antenna hold him back. Using a 40-meter dipole only 20′ high, fed with a Knight T-60 transmitter, and receiving on a Hallicrafters S-38B, Roland has worked 15 states. Look for him on 40 and

15 meters if you need a Louisiana contact; he QSL's 100%. . . . **Les Biglands, WN2DWR, WPE2CTS,** 186 Grove St., Angola, N. Y., is another of the many who have parlayed a P.E. Short-Wave Monitor Certificate into a ham license. In a week on the air, Les has worked 13 states; he agitates a 350' Windom antenna with a Johnson Ranger transmitter and listens for replies on a Lafayette HE-30 receiver. . . . **Bill Ringleben, KN3UKZ, WPE3DVP,** 305 East Elm St., Hazleton, Pa., samples the 80- and 15-meter Novice bands occasionally, but you'll find him on 40 most of the time. Running 50 watts to a Knight T-50 transmitter and receiving on a Hallicrafters S-41G receiver, Bill has QSL cards from nine states.

Perry Gorchov, WN4FRO, 10951 S.W. 60th Ave., Miami 56, Fla., *must* have a good location. Using a 15-meter dipole antenna only 10' high, he has worked Alaska, the Canal Zone, Canada, Mexico, Norway, Peru, Puerto Rico, and Venezuela; in addition, he has 30 states confirmed! All this has been on 15 meters with a Johnson Adventurer transmitter and a Hammarlund HQ-100. . . . **Arnie Kopischke, Jr., WNØDFT,** R. 4, Mankato, Minn., is a real persuasive talker. He convinced his wife that the proper place for his ham shack was in the living room! Arnie feeds a 135' doublet from a Heathkit DX-20 transmitter via a home-brew antenna coupler; he receives on a Lafayette KT-320 with an 85-kc. i.f. amplifier for increased selectivity. When not hamming or experimenting, Arnie likes to help prospective hams prepare for the FCC exams—he'll go for the General ticket, himself, as soon as he breaks through the 13-wpm code barrier. . . . **Anthony Nicoli, KN1YGQ,** 137 Whittum Ave., Springfield, Mass., shares a Heathkit DX-40 transmitter and a "surplus" Hammarlund BC-779 (Super Pro) receiver with his brother David, K1MKF. Between them they have worked about a dozen different countries, but Tony is now concentrating on getting ready for his General Class exam. . . . **Tom Leathem, WV6ZZS,** 3330 Warburton Ave., Santa Clara, Calif., has harvested 50 QSL cards from six states with a Johnson Adventurer transmitter driving a Gotham V-80 vertical antenna; a Hallicrafters SX-140 does the receiving.

Need Nevada for WAS? Well, here are two chances for you—**William E. Gotwalt, KN7TNY,** 340 Mallard Ave., and **Tony R. Morgan, KN7TRG,** 925 Mezpah St., both of Las Vegas, Nevada, will be glad to help you out. Bill runs 75 watts to a Heathkit DX-40 transmitter feeding a Hy-Gain 14-AVS vertical antenna and receives on a Hallicrafters SX-100 receiver. Tony has a Globe Scout 680-A transmitter running 70 watts, also exciting a vertical antenna, and he receives on a Mosley CM-1 receiver. . . . **Lewis "Kim" Kimmel, KN3USL,** 14305 Gaines Ave., Rockville, Md., really kept the ionosphere busy his first month on the air. His EICO 723 transmitter, Hy-Gain 2-DBP "fan" dipole antenna, and Hammarland HQ-100 receiver contacted over 100 stations in 21 states (18 verified) and Guantanamo, Cuba (KG4). Most of these contacts were on 80 meters, but he made a few on 40.

Last month we reported that **Camilo A. Castillo, HP1AC,** in Panama, looks for Novices and calls "CQ N" on weekends. The frequencies he uses are 21,015, 21,150, and 7150 kc. He operates on 15 meters weekends from 0930 to 1200 and from 1500 to 1730, EST; on 40 meters Monday through Friday from 1730 to 1830 EST. Cam says that 40-meter Novices often come into Panama well after 1730, EST, although (like the rest of us) he has trouble with short-wave broadcast-band interference on some frequencies. He tunes the Novice bands carefully for answers to his calls and will attempt to keep all skeds. If you work HP1AC, send him your QSL card c/o W2CTN, 159 Ketcham Ave., Amityville, N. Y., and include a stamped reply envelope with your card. . . . **Danny C. Malone, WA4DBE,** Rt. 3, Henderson, Tenn., closed his Novice logbook with 28 states and Canada worked—all on 40 meters. Danny uses a Heathkit HX-11 transmitter coupled to a 40-meter dipole, and a Heathkit AR-3 receiver helped along by a Q-multiplier and the c.w. filter described in our February, 1962, column. He also uses the low-power control box from the May, 1962, column.

Now that a new year is starting, why not resolve to send us *your* news and views, pictures, and suggestions for construction projects? The address is: Herb S. Brier, W9EGQ, Amateur Radio Editor, POPULAR ELECTRONICS, P.O. Box 678, Gary, Ind., 73,

Herb, W9EGQ

On the Citizens Band

(*Continued from page 76*)

the antenna—when properly installed—will accurately match your transceiver output. If you get one of these new antennas, which several manufacturers are now producing, be prepared for quite a difference in signal strength over a ground plane. They're really worth the extra money, and can at least double your ground-wave range.

Adding "Video" to "Audio." Those of you who have investigated the prices of custom-made decals will readily agree that, in small quantities, they can be a little expensive, due to basic art work and setup. However, we recently received several samples from Chuck Baer of K9TVA Enterprises who offers club decals in quantities as low as 50. Special orders are made up in as many as four colors, at from 25 to 50 cents each in hundred lots, cheaper yet in larger quantities.

Chuck has also been supplying clubs and individuals with embossed, steel li-

ATTENTION ALL CB'ERS!

As this issue goes to press, the Federal Communications Commission (FCC) has just released its long-awaited proposals for new CB rules—Docket No. 14843. The Editors of POPULAR ELECTRONICS urge all CB clubs to write the FCC (Washington 25, D.C.) immediately, request a copy of this document, and study it carefully. If you belong to a CB club, you'll want to discuss the proposed rule changes at your next meeting. This Docket has been published in the Federal Register.

As you no doubt know, any CB'er or interested party can file a comment on this Docket—either agreeing with it in principle, or objecting to certain provisions. But time is short: comments must be filed as an original and fourteen copies on or before January 15, 1963.

What are the proposals in Docket 14843? One—probably the most disturbing—would limit communications between stations of two different license holders to channels 12, 13, 14, 15, and 23 **only.** Communications on channels 1 through 11 and 16 through 22 would be permitted **only** between mobiles of the same license holder.

In plain talk, this means no more "ham-style" communications except on five channels! There's no denying that a small percentage of thoughtless CB'ers have made such a mess of the CB channels that the FCC had no alternative but to act. And there's also no denying that the effect—if this proposal goes into the rule book—will be devastating to CB as we now know it.

It is our opinion that commercial use of CB channels is confined largely to daylight hours, and that use by private individuals constitutes a very small fraction of the channel occupancy during any 24-hour period. While unrestricted two-way chit-chat is to be deplored, the allocation of a reasonable number of "sole use" channels would seem a realistic solution to this problem.

Therefore, the Editors of POPULAR ELECTRONICS intend to file a counter-proposal recommending that:

(1) unrestricted communications be allowed between units of two different license holders on channels 9, 10, 11, 12, 13, 14, and 15.

(2) restricted communications be allowed between units of two different license holders on channels 6, 7, 8, 16, and 17 from one hour after local sunset until one hour after local sunrise.

Also contained in Docket 14843:

- Redefinitions of just what the FCC means by "20-foot antenna height" and "5 watts input." (Enforcement of these two proposals could mean antenna changes for a vast number of licensees.)
- Limitation of ground-wave range for Class D operation to 150 miles.
- Invalidation of speech scramblers and phone patches. (Tone squelch would be permitted—provided that the tone duration was under 5 seconds.)
- Reduction of transmission time from the present "5 minutes on and 2 minutes off" to "3 minutes on and 5 minutes off." (Test transmissions would be "1 minute on and 5 minutes off.")

We'll have further comment on this developing situation in our next issue.

cense plates, of the same size issued motorists, along with engraved Formica club pins. For more information and a spec sheet on Chuck's identification products, drop him a line at 6429P No. Glenwood Ave., Chicago 26, Ill.

Club Chatter. Two very successful jamborees held last year have come to our attention. From the *Marshall News Messenger* of Marshall, Texas, we received word of a one-day meeting and barbecue held there by the Marshall CB Club. Some 500 CB'ers from twelve states attended. Since the club boasts only 40 members, and it was their first jamboree, this represented a considerable undertaking. (See photo on page 75.) . . . R. L. Winklepleck, vice president of the Wabash Valley Citizens Radio League, Inc., of Terre Haute, Ind., told us that over 2400 CB'ers were in attendance at their jamboree (and they're already making plans for a bigger and better one to be held this year). Besides a swap shop, equipment displays, a picnic, and concerts given by the "Chordinairs," there was a drawing for more than 100 prizes donated by electronics manufacturers and distributors, as well as merchants from surrounding communities.

The Corn Belt Citizens Banders held their second annual dinner on November 17th in Bloomington, Ill. Besides a fine smorgasbord, entertainment and door prizes made up part of the program, plus what was termed a couple of "5-minute" speakers! . . . The Mid-State Minutemen CB Radio Club of Oklahoma (P. O. Box 783, Stillwater, Okla.), chartered a year ago last October, recently assisted the National "Fly-In" student pilot match in Stillwater. Four mobile units, two walkie-talkies, and two base units in the airport tower worked with the FAA in directing planes, organizing taxi procedures, and doing their part in keeping confusion down to a minimum. They were later commended by the FAA, the mayor, the airport officials, the university, and judges of the meet for their assistance. Those of you who are just getting a CB club started will be interested to know that this group has extended an invitation to newly organized clubs to write to them for help on any

STATEMENT REQUIRED BY THE ACT OF AUGUST 24, 1912, AS AMENDED BY THE ACTS OF MARCH 3, 1933, JULY 2, 1946 AND JUNE 11, 1960 (74 STAT. 208) SHOWING THE OWNERSHIP, MANAGEMENT, AND CIRCULATION OF Popular Electronics published monthly at Chicago, Illinois for October 1, 1962.

1. The names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, Ziff-Davis Publishing Company, 434 S. Wabash Ave., Chicago 5, Ill.; Editor, Oliver P. Ferrell, 1 Park Ave., New York 16, N. Y.; Managing editor, Julian M. Sienkiewicz, 1 Park Ave., New York 16, N. Y.; Business manager, M. T. Birmingham, Jr., 1 Park Ave., New York 16, N. Y.

2. The owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding 1 percent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a partnership or other unincorporated firm, its name and address, as well as that of each individual member, must be given.) Ziff-Davis Publishing Company, 434 S. Wabash Ave., Chicago 5, Ill.; Estate of William B. Ziff, 1 Park Ave., New York 16, N.Y.; A. M. Ziff, 1 Park Ave., New York 16, N. Y.

3. The known bondholders, mortgagees, and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages, or other securities are: None.

4. Paragraphs 2 and 3 include, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting; also the statements in the two paragraphs show the affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner.

5. The average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the 12 months preceding the date shown above was: (This information is required by the act of June 11, 1960 to be included in all statements regardless of frequency of issue.) 424,811.

M. T. BIRMINGHAM, JR.
Business Manager

Sworn to and subscribed before me this 19th day of September, 1962.

(SEAL) MICHAEL A. LALLI,
Notary Public
(My commission expires March 30, 1964)

difficult questions that may come up.

The 1W Airline Club of Middlefield, Conn., would like to hear from all New England clubs interested in their plans for a CB jamboree to be held in the near future. Write Clayton Kent at 53 Bretton Rd., Middletown, Conn. . . . From the 17th Call Area in Cherokee, Iowa, the Little Soo CB Club has checked in with the column—another "country" heard from! The Little Soo's would like to swap newsletters with other clubs. Their contact is Mary M. Kohn, 221 N. 11th St., Cherokee, Iowa.

Three more excellent CB newspapers new to your CB Editor's eyes arrived this month: the *Dixie Citation* from Decatur, Ga.; the *Illini* from Champaign, Ill., and the *Ohio Valley CB Bulletin* from Shawneetown, Ill. It appears that most club publications seem to have the same problem newswise—lack of contributions from individual members. Despite the thorough coverage given CB news on a local and national basis in most of the publications, repeated requests to members for information have more-or-less become standard. Support your club newspaper as you would the goals and activities of the club. The only way "out-of-range" CB'ers can visualize your operation is through your club newspaper.

Let's hear from the rest of the clubs who haven't as yet checked in. We'd like to compile a complete club directory as soon as possible. Be sure to send your complete address. Mail us your club publication every month, and keep us informed—in advance when possible—of upcoming CB events in your area. —30—

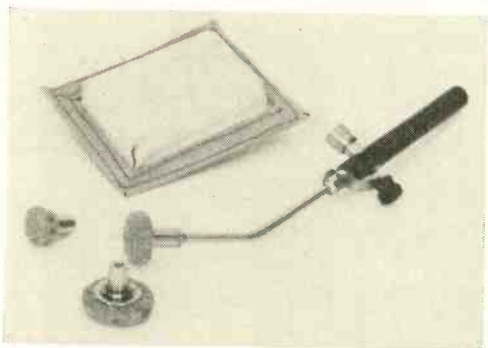
"Johnson is our best mechanism designer, but he needs more work in radio-control systems."

The Nerve Stimulator

(*Continued from page 53*)

nected to one side of the 6.3-volt winding on filament transformer *T1*, and with the base connected to the other side, sufficient feedback is provided to generate short pulses of about the same voltage as the battery. With a transformer turns ratio of about 18.5 to 1, pulses of up to 175 volts will be available across the output winding of *T1* when you use a 9-volt battery (depending on the setting of level control *R5*).

The pulse rate is controlled by the *RC* combination in the base circuit, with *R1* providing control of the frequency range selected by *S2*. If lower frequencies are desired on any given range, make either the capacitor or the resistor (or both) larger. Sufficient switch positions are available to permit adding other ranges, and it's also possible to eliminate all but one *RC* combination in cases where only a single fixed frequency is needed.



Electrode handle with interrupter key and three different-sized heads (#PC-2960) and moist-pad electrode (#PC-2941) shown above are available from J. A. Preston Corp., 71 Fifth Ave., New York 3, N. Y., for $11.00 and $2.85 respectively, plus postage.

The high efficiency of this circuit will result in good battery life. Under average operating conditions, the type 2N6 battery shown should last about 50 hours —and even more if operated at the lower pulse rates for each range. At the higher pulse rates, the battery drain will be greater. Type D flashlight cells should give up to about 150 hours of useful service.

—30—

New Products

CB TRANSCEIVER KIT

A three-way power supply in the Heathkit GW-42 "Master CB Station" allows you to dial your choice of 117 volts a.c. or 6 or 12 volts d.c. operation. The GW-42 boasts built-in 4-tone selective-call circuitry, as well as an adjustable squelch and automatic noise limiter which function with the on/off switch. There are a total of five crystal-controlled transmit and receive channels, and, in addition, variable receiver tuning on all 23 channels. The transmitter section has a nominal power input of 5 watts; modulation is automatically limited to less than 100%. Price of the GW-42, $119.95. (*Heath Co.*, Benton Harbor, Mich.)

CAPACITOR TESTER

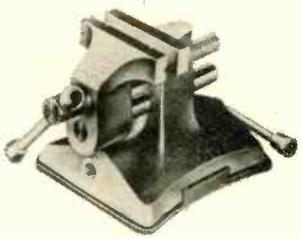
"Cappy," a tester for paper, mylar, and electrolytic capacitors, is now being marketed by Watsco. Otherwise known as Model E-2, the unit indicates leakages ranging from 1000 to 5000 megohms. A "current leakage" test for large - capacitance and high-working-voltage electrolytics is also featured; such leakage currents can't be detected by ordinary ohmmeter checks. "Cappy" can also be used to test silicon and selenium rectifiers, fuses, motor capacitors, r.f. high voltage, and insulation leakage. Price (complete with test leads), under $10.00. (*Watsco, Inc.*, 1800 W. 4th Ave., Hialeah, Fla.)

ELECTRONIC COLOR ORGAN

The "Colortron," an unusual color organ, is designed for use in conjunction with any audio system. When connected (in parallel with the speaker) to the system's output and plugged into an a.c. outlet, it translates musical passages into kaleidoscopic patterns of colored light. Red lights respond to the higher frequencies in the music, green and blue lights to the lower frequencies; the brilliance of the lights is controlled by the sound intensity. Each channel of a stereo system can be used to operate a separate Colortron. Price, $99.50. (*Colortron Co.*, P. O. Box 427, Glen Cove, L. I., N. Y.)

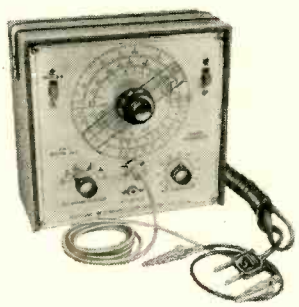
PORTABLE VISE

If the job can't be brought to a vise, bring VACU-VISE to the job. The "special" vacuum created by the flick of a lever will hold this 3-pound vise in place on any smooth, non-porous metal surface. Manufactured of tough, heavy-duty steel, VACU-VISE has 2½" jaws with "V" grooves. It can be used vertically or horizontally, and its rubber base prevents any possibility of scratching a surface. Price, $6.95, plus 75 cents for handling and postage. (*Ward Green Co.*, 43 W. 61st St., New York 23, N.Y.)



R.F. SIGNAL GENERATOR

Among the smallest and lowest priced signal generators on the market today, the EMC Model 502 is available in both wired and kit form. It features a built-in 400-cycle modulator, and it has provision for external modulation as well. The 502's six bands cover the range from 115 kc. to 110 mc. on fundamentals and up to 220 mc. on second harmonics. There are individual slug-tuned coils for each band and a Colpitts r.f. oscillator for high stability. Price: $24.95, wired; $17.95, in kit form. (*Electronic Measurements Corp.*, 625 Broadway, New York 12, N.Y.)



SWR BRIDGE/R.F. POWER METER

A new Lafayette SWR bridge and r.f. power meter, designated the TM-58, gives SWR and direct power readings to 50 mc. The 7¼" x 3⅛" x 2⅜" instrument may be

inserted permanently in the transmission line. When not making SWR checks, the meter will indicate r.f. power up to 15 watts, fed to a built-in 52-ohm dummy load or relative output power up to a kilowatt delivered to the antenna. The bridge is priced at $27.95. (*Lafayette Radio Electronics Corp.,* 111 Jericho Turnpike, Syosset, L. I., N. Y.)

TV/FM ANTENNA COUPLER

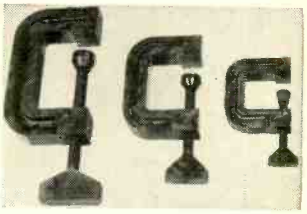
Any number of TV or FM sets can be coupled to one antenna feedline with "Transceptor" couplers — just snap one coupler around the feedline for each set to be used, without stripping or splicing. Loss encountered through use of this inductive coupler is from ¼ to ½ db, depending on frequency; isolation between auxiliary sets is 24 db, and there is little interference between sets regardless of how many are operating. Price of the "Transceptor" coupler, $2.98. (*Aerogap,* 1680 N. Vine St., Los Angeles 28, Calif.)

TRANSISTOR IGNITION KIT

You can get a much "hotter" spark in your automobile ignition system if you transistorize it with the Heathkit GD-212. Designed for 12-volt negative-ground ignitions, the GD-212 will replace your present coil with a special Mallory F-12T coil and a transistor circuit. Results: better mileage, smoother idling and acceleration, easier starting, and longer life for the engine and ignition system parts. A meter and an adjustable ballast resistor are included for optimum current setting. Price of the kit, $34.95. (*Heath Co.,* Benton Harbor, Mich.)

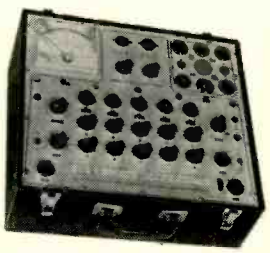
PLASTIC "C" CLAMPS

Plastic "C" clamps that won't rust, are non-conducting, and can't affect magnetic fields, are being offered by Electronic Connectors, Inc. Molded of high-strength, glass-filled nylon, they are not intended to replace metal versions in applications where brute force is required, but they provide more than enough strength for most jobs. Units with 2", 1 5/16", and ¾" openings (selling for $1.25, 98 cents, and 75 cents, respectively) are available. A set of three (one of each size) costs $2.98. (*ECI Clamp Division,* 84-45 Abingdon Rd., Kew Gardens 15, N.Y.)



TUBE/TRANSISTOR CHECKER KIT

The "Realistic" Model 113 tube/transistor checker kit tests all types of vacuum tubes, transistors, and diodes. Tubes are checked for both mutual conductance and emission, giving a more comprehensive indication of condition than the conventional "Replace" or "Good." In the mutual conductance test, not only are d.c. voltages impressed on the screen and plate —but the voltage is swept over a wide range to make sure the readings are accurate under all conditions. Provision is made for short tests, and both tube bias and filament current can be read on the meter. Price: $99.95 in kit form; $179.95 factory wired. (*Radio Shack Corp.,* 730 Commonwealth Ave., Boston 17, Mass.)



FOUR-BAND RECEIVER

A moderately priced unit, the "Globeceiver" tunes standard AM broadcast stations as well as three short-wave bands. The four frequency ranges cover 540 kc. to 30 mc. An internal loopstick antenna is used for BCB reception, and a telescoping whip for SWL'ing. The 3" x 5" speaker is automatically cut out when a pair of phones is plugged in, and there's a beat frequency oscillator for copying code. Price, $64.95. (*GC Electronics Co.,* Globe Div., 400 S. Wyman St., Rockford, Ill.) —30—

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Transistor Tester Roundup

(*Continued from page 70*)

illustrated in Fig. 4. Here, base and collector biases are obtained from constant current d.c. power supplies. Small resistors (*Rb* and *Rc*) are connected in series with the base and collector electrodes to permit tests with an a.c. VTVM, and a known a.c. signal is applied to the base and emitter.

The base input signal current is proportional to the a.c. voltage developed across *Rb*. The amplified output signal current is proportional to the a.c. voltage measured across *Rc*. The transistor's *beta*, then, is equal to the ratio of the output to input signal currents. If *Rb* and *Rc* have the same value, *beta* may be determined by dividing the voltage measurement across *Rc* by that across *Rb*. If the input signal current is kept at a fixed known value, then *beta* is directly proportional to the voltage (a.c.) across *Rc*, and the meter used to check this voltage can be calibrated directly in terms of *beta*.

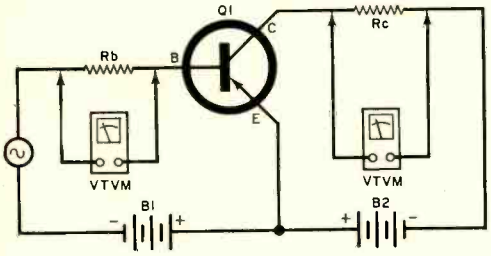


Fig. 4. Basic circuit arrangement for a dynamic beta measurement.

For maximum accuracy, it is important that this test be performed at specified bias currents, for a transistor's *beta* varies with bias. The dynamic test for *beta* is roughly analogous to a dynamic test for *mutual conductance* when referring to vacuum tubes.

Another type of dynamic test is illustrated in Fig. 5. Here, the transistor is connected as a simple oscillator. If the transistor is neither "open," "shorted," nor excessively "leaky,"—and if it can provide a minimum gain—the circuit will oscillate, developing an a.c. output signal. This can be identified by some type of indicating device—such as an earphone, neon bulb, or a.c. voltmeter—connected across *T1*'s output secondary winding. A variable base bias (by means of *R2*) allows different transistors to be checked under similar conditions, thus permitting the "matching" of identical pairs for push-pull applications.

Commercial Testers. A number of currently available commercial transistor testers are listed in Table 2. As might be expected, these testers can be divided into two broad classes: *static* testers, and *dynamic* testers. The majority of instruments are designed for static tests, using variations of the circuit illustrated in Fig. 3.

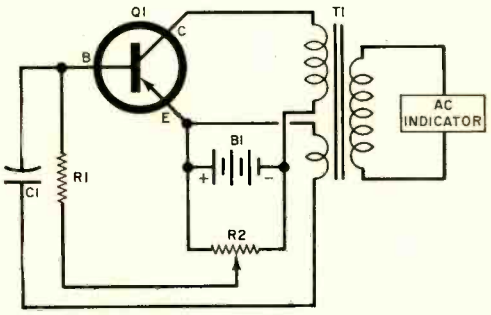


Fig. 5. Typical circuit used in some types of dynamic transistor checkers. Note that this is essentially a simple audio oscillator.

As a general rule, the less expensive units apply a fixed bias for leakage and d.c. *beta* tests regardless of the type of transistor checked. The more costly instruments, on the other hand, permit tests with different bias voltages and currents, more nearly duplicating the original manufacturer's test conditions and permitting a more accurate determination of transistor quality. While the costlier instruments are more accurate, they are somewhat more difficult to use, since a moderate amount of "set-up" time is required; in this respect, they are used much like conventional tube testers.

Since all of the commercial transistor testers listed in Table 2 are made by reputable firms, the best guides to choosing a particular instrument are: (a)

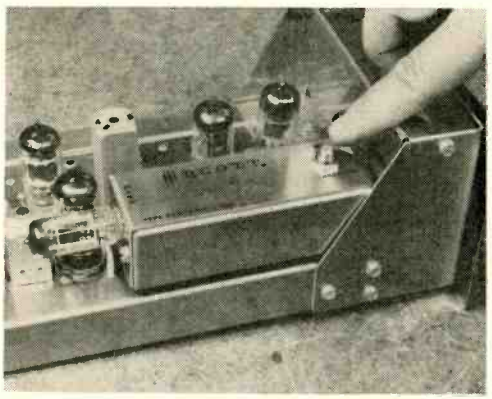
your pocketbook, (b) the type of work you do, (c) the specific operating features you prefer. As a general rule, obtain the best instrument you can afford. An experimenter may choose an instrument capable of precise tests, while a service technician might prefer a unit suitable for fast checks. —30—

Hi-Fi Lab Check

(*Continued from page* 59)

The LM-35 is a high-output multiplex adapter, and our test model gave a maximum output of 4.8 volts. This output is too high for average use, but can easily be reduced by the *Level* control on the front panel. At a moderate setting of the input level (0.25 volt composite signal), the distortion introduced by the LM-35 is only 0.8%. The adapter will lock on a signal with 10 mv. of pilot carrier.

IN CLOSING: The Editors are pleased to see H.H. Scott make the Model 335 multiplex adapter available as a kit, thus insuring continued popularity for this top-quality item by making it familiar to the kit builder. For premium FM-stereo reception by anyone with a wide-band mono FM receiver, the LM-35 is a good investment. —30—



An optional extra, the Model 55 "Stereo Guide" comes completely assembled and can be mounted right on the LM-35 chassis. Threshold control (under finger in photo) is adjusted so that light on front panel of LM-35 turns on whenever the FM station being received broadcasts FM-stereo.

Measurement Quiz Answers

(*Questions on page 44*)

1 TRUE. If a voltmeter is rated at 20,000 ohms-per-volt, it has an input resistance of 100 times 20,000 ohms on its 100-volt scale, and 600 times 20,000 ohms on its 600-volt scale. The higher this shunting resistance is, the less it reduces the resistance across which the voltage is measured.

2 FALSE. If the instrument does not have a transit (shorting) position, set it on its highest current range—because the meter will then be using its lowest value of shunt resistance. If the meter coil is jiggled while being moved, the voltage it generates can produce the largest amount of damping current.

3 TRUE. Glass—and especially plastic—meter faces will have a static charge built up on them when they are rubbed with a dry cloth. The static charges will attract the needle on the inside, and more dust on the outside. Use a cloth dampened with anti-static fluid (such as Weston's "Statnul").

4 FALSE. Use the highest current range because the ammeter pointer is least apt to "pin" against a stop. Once the current magnitude has been determined, step down to lower current scales.

5 TRUE. Meter friction due to worn bearings or dirt tends to make the needle stop too soon when it is slowing down for an indication.

6 FALSE. Most meters are of the D'Arsonval type, which responds to the average value of the signal waveform. An a.c. meter scale increases this reading by a factor of 1.11 in order to indicate r.m.s. values of sine waves. For a square wave, r.m.s. and average are the same; hence, the factor is not needed and the meter will read high.

7 TRUE. An ammeter deflects correctly when electrons enter its negative terminal and leave by its positive terminal.

8 TRUE. If the accuracy of a meter is given, for example, as 3% of full scale deflection, it means that a reading taken anywhere on that particular range is accurate to only 3% of the total range on that scale. Therefore, if reading accuracy is what you want, select the smallest range that can indicate your reading.

9 FALSE. When determining low resistances, don't measure the voltage drop across both the unknown resistance and the ammeter. The ammeter resistance might be of the same magnitude or greater than the unknown resistance and introduce large errors.

10 TRUE. In selecting the highest voltage scale, you reduce the possibility of "pinning" the pointer against a stop. Once the voltage magnitude is determined, step down to lower voltage scales.

Transistor Topics

(*Continued from page 82*)

tion on battery voltages from 6 to 12 volts, the module offers both high- and low-impedance inputs and will match output loads of 3.2 to 45 ohms. (Saxton Products, Inc., 4121 Park Ave., New York 57, N.Y., is the national distributor for the "Mity-Amp," which carries a suggested list price of $8.95, and will be available through regular electronics outlets.)

Possible circuit module applications in hobbyist projects are virtually unlimited. For example, the AM tuner could be added to a portable phonograph or tape recorder, or it might be employed with a battery and earphone to assemble a pocket receiver. Again, it could be used in conjunction with an audio amplifier module, speaker, battery, and volume control to assemble a complete portable receiver. In a similar fashion, the audio amplifier module could be combined with a speaker, battery, and suitable probe to assemble a signal tracer.

Product News. The Freeman Electric Co. (Freeman, Mo.) is now producing a unique electronic self-protection device known as a "Shock-Rod." In operation, the unit delivers 4000 volts at limited current to a pair of tiny electrodes on the end of a 10-oz., 29″ aluminum cane. It can be used for protection against vicious dogs, bulls, or even wild animals. Operating power is supplied by a pair of standard C cells, with the battery voltage stepped up by means of a transistorized circuit. The "Shock-Rod" sells for $14.95, postpaid, direct from the factory, but it is also available at the same price through local dealers.

A brushless d.c. motor has been introduced by the Barber-Colman Co., (Rock St., Rockford, Ill.). Unlike conventional d.c. motors, the new unit has no brushes to wear out and no arcing contacts to produce electrical interference. Rather, it is a modified shaded pole (a.c.) induction motor powered by a simple transistorized d.c. inverter.

Until next month, good luck with your projects—and New Year's resolutions!

—*Lou*

Surplus Earpiece Bonanza

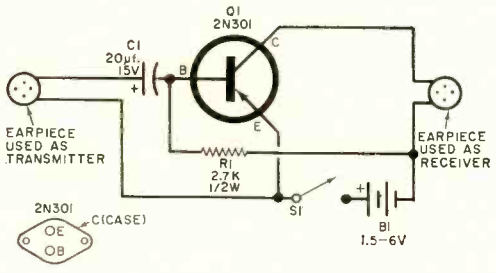
(*Continued from page 73*)

to the metal enclosure and wire one of the transformer primary leads to it. The other primary lead is soldered to the transformer frame (which, in turn, should make good electrical contact with the enclosure). Connect the secondary leads to the terminals of the earpiece, and you're finished.

There's some possibility that the mike may introduce hum when used with a high-gain amplifier. If this should happen, try soldering a wire from the metal retaining rim of the earpiece to the transformer frame.

Children's Telephone. A sound-powered telephone that will delight any child can be made simply by connecting the terminals of one earpiece to those of another via a length of zip cord. Each earpiece doubles as a transmitter and a receiver. Since there's no amplification, however, it's necessary to talk close to the units and in a loud voice.

The schematic diagram shows a circuit for a telephone with much more volume. One transistor and a minimum



Children's Telephone Amplifier. Most pnp power transistors can be used in this simple circuit.

of other parts are used to do the amplifying. Power can be supplied by any battery of from 1½ to 6 volts, depending on how much amplification is required.

The only disadvantage with the above hookup is that one earpiece serves only as a transmitter, the other only as a receiver. It's inexpensive, though, to build two sets if you'd like to make two-way conversation possible. —30—

Short-Wave Report

(*Continued from page 84*)

has evidently returned to the air since Mr. Perolo compiled his listing, please refer to the current station report section below.

Extra! One of our West Coast reporters has told us about a station operating in the Los Angeles area on 690 kc. with an ID of *Extra news over Los Angeles.* According to newspapers in the area, the call-sign is said to be "XTRA" (*World Radio Handbook* lists it as XETRA"). The location was presumed to be along the Mexican border below San Diego but an automobile ride to that section confirmed the fact that the strongest signals were from the Los Angeles area; in fact, the signal disappeared below San Diego. Does anyone have more details?

Current Station Reports

The following is a resume of current reports. At time of compilation all reports are as accurate as possible, but stations may change frequency and/or schedule with little or no advance notice. All times shown are Eastern Standard and the 24-hour system is used. Reports should be sent to P. O. Box 254, Haddonfield, N.J., in time to reach your Short-Wave Editor by the eighth of each month; be sure to include your WPE call letters and the make and model number of your receiver. We regret that we are unable to use all of the reports received each month, due to space limitations, but we are grateful to everyone who contributes to this column.

Angola—CR6RB, *R. Ecclesia,* Luanda, now on 11,757.5 kc. (having moved from 11,745 kc.) is noted at 1535 with Portuguese music, at 1555 with a religious program; s/off is at 1600 without the anthem "A Portuguesa." This station is also often heard before 1300 and from 0030 s/on, with Portuguese news at 0100.

Australia—The N.A. xmsns reported last month as being aired at 2000-2300 are now on 15,315 kc. (a change from 15,370 kc.) and 17,840 kc. Many reports indicate very poor reception except at scattered West Coast points. English newscasts are given at 2030, 2130, and 2230.

The University of New South Wales, Box 1, Kensington, Sydney, operates VL2UV on 1750 kc. with 300 watts power on Tuesdays and Wednesdays at 2330-0030. The station does verify but may not be in use during the month of January. This could be considered as an exceptional DX catch by North American listeners. To date: no reports.

Bolivia—CP-38, *La Cruz del Sur,* La Paz, has returned to 9440 kc. where it is noted broadcasting in Spanish around 2123 and in Eng. at 2130-2145.

Brazil—*R. Globo,* Rio de Janeiro, 11,905 kc., is being tuned in Portuguese at 1700 with news, music and commercials at 1710, talks at 1730, news at 1800, and sports news at 1805.

Canada—Montreal now broadcasts to the Caribbean and Latin American areas in Eng. from 1800 to 1830, in Portuguese to 1900, and in Spanish to 1945 on 9655 kc. (new) and 11,720 kc. The Northern Service now reads: 1655-1746 and 1958-2130 on 11,720, 9585, and 6120 kc.; and 2130-0205 on 9585 and 6120 kc. The 6120-kc. outlet replaces 5970 kc.

Colombia—The newest schedule from *R. Sutatenza,* Bogota, reads as follows: weekdays at 0545-0730 and 1445-2010 on 5095 kc. (HJGG, 50 kw.), 3250 kc. (HJGO, 10 kw.), and 6075 kc. (HJCT, 10 kw.), and at 0545-0900 and 1345-2010 on 5075 kc. (HJGC, 25 kw.); Sundays at 1100-2100 on all of the above frequencies. These stations are part of the Accion Cultural Popular System.

Radiotelevisora Nacional, Bogota, 4955 kc., verifies with a cordial letter from the Minister of Communications. Reports go to Transversaal 17 No. 25-65, Bogota.

HJGF, *R. Bucaramanga,* 4835 kc., is noted at 2230-2300 with Spanish and some English.

Cuba—*Radio Havana Cuba* is now operating to N.A. in Eng. at 2200-0100 on 5990 and 6015 kc. (replacing 11,875 and 11,840 kc.) An unlisted channel is heard on 9995 kc. at 1550-1558 with talks in Spanish, IS, ID, and a march.

Dominican Republic—*R. Sol,* Higuey, 3265 kc., is a previously unreported station with a schedule of 0700-2200. The rated power is 1000 watts.

Ecuador—A booklet called "Seeds of the Wind" (a story of the history of HCJB) can be obtained for $1.00 from Box 691, Miami 47, Fla.

Egypt—Cairo's Eng. schedule reads: to Europe and Africa on 11,915 kc. and to Africa on 7075 kc. at 0130-0200; to Europe on 11,915 and 9495 kc. (late reports indicate that

Yves Moreau, VE2PE1DQ, Montreal, Canada, listens on a 1155 surplus set, and has a Marconi No. 9 standing by. His antenna is a 60′ long-wire. Note that Yves uses a tape recorder for SWL'ing. His record: 32 countries logged, 26 of them verified.

9495 kc. has been replaced by 9475 kc.) at 1630-1730; to West Africa on 17,690 kc. at 1430-1515; to Africa on 17,905 kc. at 1245-1330; and to S. & S. E. Asia on 17,920 kc. at 0830-0930. Other reports indicate broadcasts on 17,720 kc. at 0950-1015 to East & Central Africa with Arabic music and Amharic language; on 7075 kc. at 1530 with Arabic chanting and different programs than those presented on 7050 kc. at the same time; and on 9638.5 kc. from 1645 s/on with Eng. news, 1655 with commentaries.

Ethiopia—*R. Addis Ababa* operates on 11,955 kc. from 1510 to 1530 in Eng., to 1545 in French. A newscast in French is given at 1545 and s/off is at 1550.

Fiji Islands—Suva may be using their new 10-kw. xmtr on 4755 and 5980 kc. They are noted at 0130-0230 in Eng., but may not operate in parallel; the 5980-kc. outlet has a London news relay at 0200. The 4755-kc. channel has also been tuned from 0502 to 0533 s/off with jazz and all Eng. anmts.

Germany (West)—*Deutsche Welle*, Cologne, operates to N.A. at 1530-1610 on 9735 and 11,795 kc., at 1920-0000 on 6145 and 9605 kc., and at 0000-0040 on 6110 and 9735 kc. Recent changes in the German language schedule are as follows: to Eastern N.A. at 1900-2200 on 9640, 9545 (replacing 9575), and 6100 kc.; to Australia and the Far East at 1620-1700 on 11,795, 9735, and 7235 kc. (replacing 7290 kc.); to Russia at 1325-1405 on 11,905 and 9735 kc. (replacing 15,285 kc.); to Poland at 0840-0910 on 9735, 7205 (replacing 7290), and 6110 kc. (replacing 11,715 kc.); to Hungary at 0920-0950 on 9735, 7205 (replacing 11,715), and 6110 kc.; to Yugoslavia at 1000-1030 on 11,925 (replacing 11,945), 9735, and 7205 kc. (replacing 7290 kc.); and to Czechoslovakia at 0600-0630 on 9735, 7205 (replacing 11,795), and 6145 kc. (replacing 6110 kc.). All reports

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Your Short-Wave Editor is pleased to announce that he still has available, in limited quantities, the following:

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- Leaflet K — QSL & SWL Card Printers
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- Leaflet M — Table of Call-sign Allocations
- Leaflet N — Reporting Information

Send your request for whichever items you would like to have to: Hank Bennett, Short-Wave Editor, POPULAR ELECTRONICS, P.O. Box 254, Haddonfield, N.J. Please include return postage with your request to help defray the cost of mailing. There is no other charge for any of the above items.

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William Dickerman *(WPE3BEB)*, Williamsport, Pa.
John Wallis, Jr. *(WPE3DJF)*, Philadelphia, Pa.
Charles Zapf *(WPE3DSO)*, Baltimore, Md.
Bill Wilson *(WPE3DUC)*, Folcroft, Pa.
Richard Few *(WPE3DVQ)*, Rockville. Md.
George Cox *(WPE3NF)*, New Castle, Del.
Tommy Thompson *(WPE4AIP)*, So. Boston, Va.
Grady Ferguson *(WPE4BC)*, Charlotte, N.C.
Chuck Edwards *(WPE4BNK)*, Fort Lauderdale, Fla.
Sheldon Daitch *(WPE4EDU)*, Louisville, Ga.
James Phillips *(WPE4EDV)*, Waverly, Va.
Ferrell Cooper *(WPE4EFQ)*, Crane Hill, Ga.
Dick Lipscomb *(WPE4FCS)*, Norfolk, Va.
Roger Legge *(WPE4FI)*, McLean, Va.
Bill Harrison *(WPE4FSJ)*, Nashville, Tenn.
Jody Coles *(WPE5CSW)*, Houston, Texas
Bruce Churchill *(WPE5CTK)*, New Iberia, La.
Matt Collins *(WPE6BZM)*, Los Angeles, Calif.
Bill Lund *(WPE6CJ)*, Manhattan Beach, Calif.
Ted Drew *(WPE6CMS)*, Arcadia, Calif.
Geofirey Ashford *(WPE6CWE)*, San Carlos, Calif.
Lloyd Foote *(WPE6DRR)*, Newhall, Calif.
Walter Home *(WPE6DZC)*, San Francisco, Calif.
V. Olimpio Varsogea *(WPE8DLL)*, Monroe, Mich.
Robert Eddy *(WPE8EQW)*, Newport, Ohio
Robert French *(WPE8FGH)*, Bellaire, Ohio
Mike Kander *(WPE8MS)*, Dayton, Ohio
Robin Fisher *(WPE8OG)*, Beach City, Ohio
Kenneth Shafer *(WPE9DCK)*, Whitestown, Ind.
Burt Porter *(WPE9DEN)*, Connersville, Ind.
Charles Schechner, Jr. *(WPE9DSB)*, Homewood, Ill.
Dennis Eckert *(WPE9EDV)*, Lombard, Ill.
Mrs. E. A. Best *(WPE9EFW)*, Grayslake, Ill.
Rich Appelhans *(WPE9EOV)*, Chicago, Ill.
Bob Domek *(WPEØBKL)*, Alexandria, Minn.
Bob Hoyes *(WPEØCJM)*, Bethel, Kan.
Larry Wissbaum *(WPEØCXW)*, Arvada, Colo.
John Yokoff *(TA3PE1J)*, Diyarbakir, Turkey
Donald Christensen *(VE2PE1DF)*, Montreal, Quebec
Tom Hamp *(VE3PE1JG)*, Brantford, Ontario
George Kennedy *(VE3PE1MT)*, Kingston, Ontario
Allan Buckshon *(VE7PE6F)*, Vancouver, B.C.
Bernard Brown, Derby, England
Lloyd Day, Huntsville, Ontario
Cal Merchant, Dallas, Texas
Gary Patterson, Rosedale, Miss.
Wayne Winston, University Park, Pa.
Radio Canada, Montreal, Quebec
Radio Havana Cuba, Havana, Cuba

go to *Deutsche Welle*, KOLN, Funkhaus WDR, Postfatch 344, Germany.

Gilbert & Ellice Islands—VTW2, Tarawa, has moved up to 6051 kc. and is noted from 0240 with island-type music, Eng. from 0245 to 0300. From 0303 the language used was Pidgin-English or, possibly, Gilbertese. HCJB, 6050 kc., provides considerable QRM.

Guinea Republic—Conakry is heard on a new frequency of 3376 kc. at 1730 with French announcements, then native music. The signal is excellent.

India—According to *Sweden Calling DXers*, *All-India Radio* is now scheduled for Eng. at 1445-1545 on 11,955, 9690, 9635, and 7235 kc. This may be the Europe/United Kingdom xmsn.

Indonesia—Jogjakarta has been noted for the first time on 7255 kc. at 0540-0645 with dance music, religious choral selections, and a newscast at 0630.

Iraq—*R. Baghdad* has been heard as late as 1640 in Eng. on 9635 kc., although its regular Eng. schedule is 1530-1600.

A new outlet on 6155.5 kc. has been tuned from 2125 with IS, Arabic ID at 2130 as *Idhaat al Jumuriyah al Iraqiyah fee Baghdad*, then chanting; an Arabic newscast is given at 2200. This was dual to 6180 kc. but not to 6030 kc. which was on at the same time.

Libya—Benghazi, reported in some club bulletins as having moved to 9622 kc., is actually still on 9894 kc., where it has been noted around 1345 and at 1630-1700 in Arabic. Talks precede the 1700 close-down.

Netherlands—The latest schedule for the "Happy Station" programs in Eng., on Sundays only, reads: to Australia and New Zealand at 0100-0225 on 11,780, and 9630 kc.; to the Middle East and Europe at 0530-0700 on 15,425, 6020, and 5980 kc.; to Africa, the Middle East, and Europe at 1100-1230 on 17,775, 15,425, and 6020 kc.; to South America and Spain at 1600-1730 on 11,730, 6085, and 6020 kc.; and to North America at 2100-2230 on 9590, 6035, and 5985 kc. Weekday programs in Eng. are beamed to Australia, New Zealand, and the Pacific area at 0200-0250 on 11,730 and 9590 kc.; to South Asia at 0900-0950 on 17,810 and 15,445 kc.; to Africa and Europe at 1430-1520 on 15,425 and 11,950 kc. and to Europe on 6020 kc.; to Europe and N.A. at 1630-1720 on 11,730 and 9590 kc. and to Europe on 6020 kc.; and to N.A. at 2030-2120 on 9590, 6035, and 5985 kc. *R. Nederland* was recently noted quoting items from this column on their DX program.

New Guinea—According to a letter from the station, *Hollandia Radio*, West Papua, is now operating on 7490 kc. in Dutch at 0800-1030.

Nigeria—Western Nigeria B/C Service, Ibadan, is now operating on 3380 kc. and has been noted around 1645 with Eng. ID and talks. The signal was still at a good level when checked at 1715.

Peru—Here is a resume of some of the stations noted recently on the West Coast.

R. Continental operates OAX6D on 9350 kc. and is heard from 2200 to 0000 s/off with commercials and music. (The station also maintains OAX6E, 3290 kc., but this outlet is currently inactive.) Reports go to Rivero 101, Arequipa.

R. Atlantida, 9625 kc., 1 kw., is tuned from 2300 to 2355 s/off with talks and commercials in Spanish. They will only verify reports that are written in Spanish. Reports should go to Apt. 277, Iquitos.

R. America, Lima, 9450 kc., is a difficult station to copy; try for it around 2000. *R.*

Panamericana, 5980 kc., 5 kw., Lima, is tuned from 2300 to 0000 s/off daily with music and commercials.

A new station is *R. Chiclayo,* OAX10, Chiclayo, on 5680 kc. with s/off at 0000 and a poor signal. They reportedly verify by registered mail.

Portuguese Timor—A station believed to be in this country has been heard on 3270 kc. at 0600. Further details would be appreciated.

Senegal—A station in Ziguinchor is strong at 0215 with West African music and announcements in native language. The frequency is 3336 kc.

Sierra Leone—A station reported earlier in this column as Suva, Fiji Islands, 5980 kc., may in reality be the Sierra Leone B/C Service, Freetown. It has been noted on a Sunday from 0100 s/on to 0145 with religious programs, to 0200 with national news in Eng. and native language, and from 0200 with a London news relay. English is also heard on 3316 kc. at 0155-0245 but the signal is weak.

Spain—A Spanish outlet, which seems to be located in Barcelona, has been found on 7850 kc. from 1400 with programs of Spanish music, news, and talks. On some days, a considerable amount of gypsy-type music is played. This one can be heard to past 1700 but may often be buried beneath Morse code interference.

Sudan—*R. Omdurman,* Khartoum, has moved from 4993 to 5018 kc., and was heard from 1530 with instrumentals and from 1550 to 1600 s/off with Arabic news.

Swan Island—The long-discussed location of *R. Americas* (previously called *R. Swan*) has been revealed to be—as thought by many—Swan Island, although reports over the past two years have listed Navassa Island, the Florida Keys, and "aboard a ship" as being likely locations. The station is now issuing verifications in the form of a beautiful multi-colored postcard. A letter to your Short-Wave Editor from one of the operators (who we met some years back before he became associated with the station) tells of experimental xmsns being conducted on 1165 kc., possibly to avoid QRM from WJJD, Chicago, and KSL, Salt Lake City, both of which are on 1160 kc. The present schedule lists operations at 0500-0800, 1200-1400, and 1800-0000, with Eng. at 1800-1830. The address given on the verification envelope is: Vanguard Service Co., 911 Langford Building, 121 S. E. 1st St., Miami 32, Fla., although reports going *to* the station presumably should continue to be sent to *R. Americas,* P. O. Box 352, Miami 1, Fla.

SHORT-WAVE ABBREVIATIONS

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

Switzerland—Berne's newest schedule reads: to N.A. at 2030-2215 and 2315-0000 on 11,865,

9535, and 6165 kc. (there is a DX Show on Fridays at 2100 and 2345); to the United Kingdom and Ireland at 1345-1530 on 9545 and 7210 kc.; to Australia, New Zealand, and the Far East at 0400-0545 on 21,520, 15,315, and 11,865 kc.; to S. E. Asia and Japan at 0745-0930 on 21,520, 15,315, and 9665 kc.; to India and Pakistan at 0945-1530 on 17,795, 15,315, and 11,865 kc.; to the Middle East at 1145-1530 on 11,865 and 9665 kc.

Tunisia—Tunis has been varying from 6092 kc. to 6096 kc., and has been noted with a strong signal in Arabic from 1530.

Uruguay—A new station is CXA64, *La Voz de Melo,* Melo, 15,230 kc., heard at fair level at 1700-2200.

USSR—*R. Tashkent* has been noted at weak level from 1535 with vocal music, followed to close at 1700. *R. Ulan Bator* has also been noted with a weak signal at 1800 with native news and talks; this one opens around 1700 and is often blocked by unmodulated carriers. Frequencies: Tashkent, 5925 kc.; Ulan Bator, 10,886 kc.

Venezuela—*R. San Cristobal,* San Cristobal, is now operating on 9570 kc. at 0530-2230 and replaces the *Ondas del Torbes/La Voz del Tachira* relay formerly operated on this channel. *Ondas del Torbes* is on 9640 kc., heard at 0530-0800.

YVMQ, *R. Barquisimeto,* 4990 kc., gives an ID on the hour and half hour, and is heard evenings.

One of the strongest signals from this country is that of YVLK, *R. Rumbos,* Caracas, 4970 kc. With frequent, unmistakable ID's, it is easy to log. Try for it evenings, and send your reports to Apt. 2618, Caracas.

West Congo—Brazzaville has apparently been experimenting recently on 11,710 kc. from 1900 to 2100 s/off with French music and news; the normal frequency is 11,725 kc. A new frequency is 3231 kc., and an xmsn has been heard on this channel from 1700 to 1750/close, with French news at 1740. —30—

"Watch that feedback . . ."

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Name ..... Ham Call-Area Prefix .....

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

Receivers — Make ..... Model .....

Make ..... Model .....

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

Type of Antenna Used .....

Signature ..... Date .....

One Receiver—All Bands

(*Continued from page 43*)

spool from the vise, unwind more wire, reclamp the spool, and continue winding. If you take your time, you should have a professional-looking winding job with the wire tightly wound and uniformly spaced.

When the proper number of turns has been wound on, cut off the wire (leaving a lead of about 6″), put the wire through the proper hole in the form, place your thumb over the hole to hold the wire in place, remove the insulation from the wire, push the wire through the proper base pin, and solder it in place.

Incidentally, it's especially important that the secondary and tickler coils (*L2* and *L3*, respectively) be wound in the same direction. If they're not, the regenerative detector won't operate properly. In the event that you experience trouble in getting the set to oscillate, try reversing connections to either *L2* or *L3* —not both!

Although information on the other coils is given below, it will probably be better for you to skip over to the "Operation" section at right, read that material, and try the receiver. Then you can come back and wind the other coils.

Three of the coils are single-layer affairs, and are all wound in the same manner (one being the broadcast-band coil described above). However, it's impossible to place enough wire in a single layer on the 250 - 600 kc. coil, so a different winding style is used for this one.

To wind the 250 - 600 kc. coil, drill all of the holes in the form, but wind the secondary coil (*L2*) first. Solder one end of the wire in place and make several large looping turns up to the hole at which the secondary coil will end. Now start back down the coil and wind in the same manner, reaching the hole in the form where the coil started in only a few turns. Continue winding up and down the form until the specified number of turns are in place. The purpose of this winding method is to make as many of the turns as possible cross at angles rather than lie parallel and thus reduce the distributed capacitance.

After the secondary has been completed, wind the primary (*L1*) and tickler (*L3*) coils at the proper ends of the form. These coils should be scrambled-wound, with the turns touching the ends of the secondary. Strips of plastic cement or coil dope can be run vertically at ½″ intervals around the forms to hold the wires in place.

Operation. Check the wiring, connect the power supply to the receiver with the power supply cable, and plug in the broadcast coil. Connect an antenna to the *ANT 1* binding post (*J1*), and a ground to the *GND* binding post (*J3*). Set the *REGEN* control (*R2*) in the extreme counterclockwise position, the *ANT* (*C1*) and *GAIN* (*R6*) controls in the extreme clockwise position, and the *VERNIER* control (*C3*) in the center of its range.

Turn on the power supply. After warm-up, turn the *REGEN* control clockwise until a hissing sound is heard in the speaker. Now back off the control until the hiss just stops; this is the most sensitive point for reception of AM stations.

If you have trouble separating strong local stations, turn the *ANT* control counterclockwise. This increases the selectivity by decreasing the coupling of the antenna to the receiver. With extremely strong local stations, it may be necessary to use a very short antenna to limit the signal strength.

When you use the short-wave coils, you'll find that adjusting the tuning and regeneration controls is more critical. Tuning is best done by adjusting the main dial to the vicinity of the station you wish to hear and then doing the fine tuning with the *VERNIER* capacitor. Set the regeneration control to the point where the hiss starts to receive c.w. signals; and just below this point to receive phone signals. If the receiver refuses to oscillate at certain dial settings, change the antenna coupling by means of the *ANT* capacitor, or try the alternative antenna connections shown in the diagram on page 40.

With the long-wave coil in place, the receiver should handle about as it does on the broadcast band. And don't forget that additional coils to extend the range in both directions can be wound in a cut-and-try fashion. —30—

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POPULAR ELECTRONICS
January 1963
Advertisers Index

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1963 CATALOG No. 630

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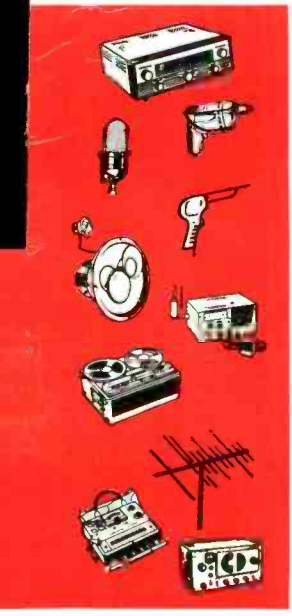

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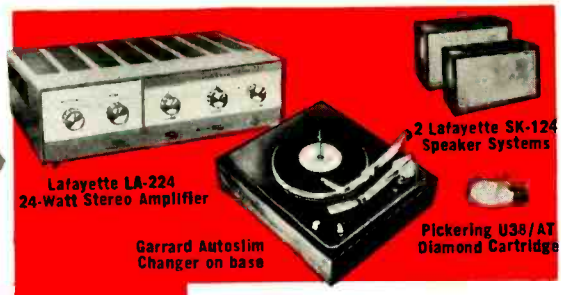

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